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AUGUST, 1826.

ON ENGRAVING.

(From the Mechanic's Gallery, By C. F. Partington.)

(Continued from p. 12.)

On Etching.

In etching, the strokes and dots on the copper-plate, instead of being cut with a tool, are corroded by an acid, by which means the effect of engraving is produced, with great expedition. To perform it, the plate is covered with a thin coat of a resinous substance, upon which the acid employed, has no action; the design, and all the lines it requires, are next traced with a steel point, so as just to cut through the resinous substance; an acid is then poured upon the plate, and allowed to remain on it, till it has corroded the metal to a sufficient depth, in all the places where the tracing has been made.

The resinous composition which is laid upon the plate, is called the *ground;* and the instruments which are used to make the requisite lines upon it, are called *etching needles.* A dry point may in fact be used as an etching needle, and *vice versa*, and the manner of whetting both is the same; but etching needles are required of several thicknesses. They generally consist of pieces of steel wire, about two inches in length, inserted into cylindrical handles of hard wood, about five inches long, and the third of an inch, in diameter. The steel tapers gradually towards the point, except a small portion of the extremity, which is made conical. They are whetted in a small groove made at one end of the oil-stone.

A great variety of compositions have been recommended for etching grounds, and almost every artist has some peculiarity in the mode of preparing the one he uses; but the general nature of the ingredients is in all the same. There are three kinds of grounds in use, the hard, the common, and the soft; and for each kind, the following recipes may be considered as of the best authority.

For a soft ground, take one ounce of white, or bleached bees' wax, one ounce of asphaltum, half an ounce of common pitch, and half an ounce of Burgundy pitch. Melt the wax over a slow fire, in a pot of glazed earthenware; add to it the rest of the ingredients by little and little, stirring the mixture all the time it is on the fire. The asphaltum should be pounded in a mortar before it is put in. Care must be taken to prevent its burning, by using a low heat. When the whole is thoroughly melted and incorporated, take it off the fire, throw the whole mass into a vessel of clean warm water, and knead it with the hands, into balls about the size of walnuts, or a little larger.

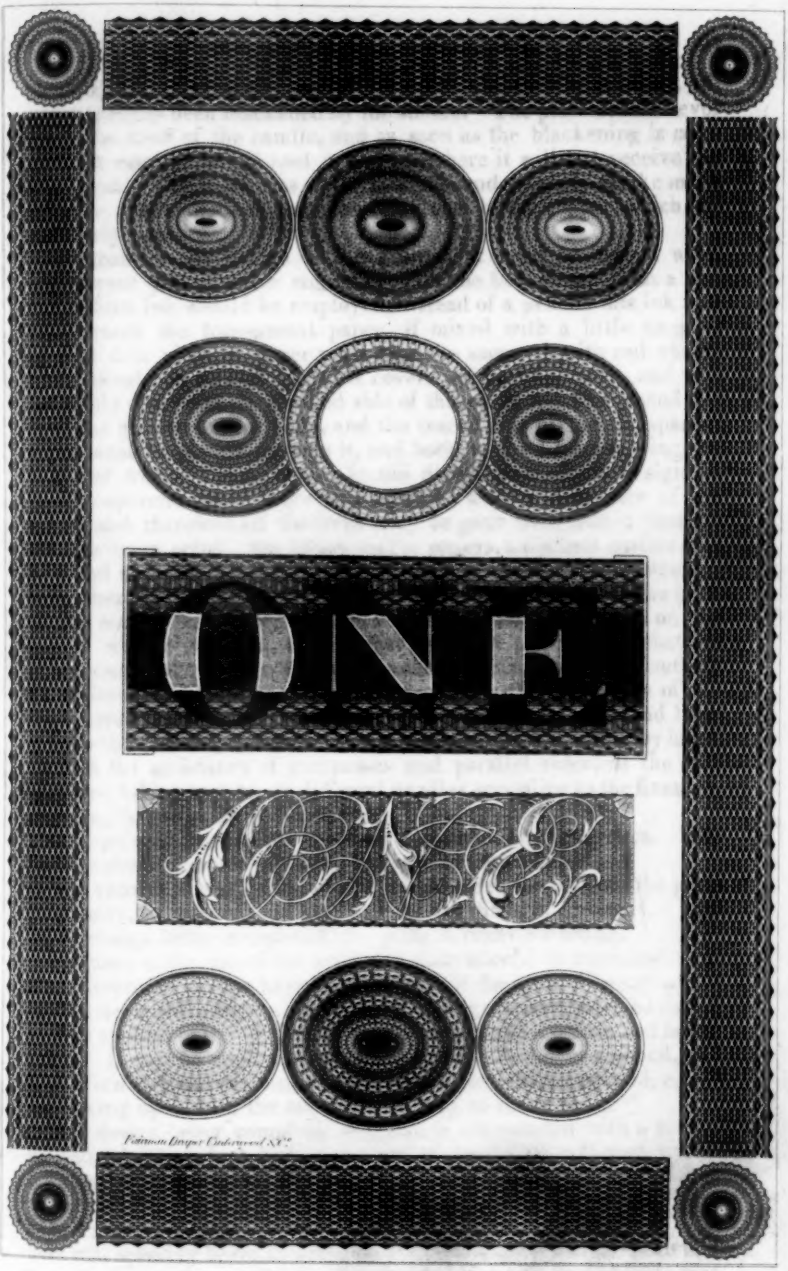
In summer, the ground should be made rather harder than in winter, by increasing the quantity of asphaltum, or continuing the boiling for some time after the incorporation of the ingredients.

For a common ground, the composition is a medium between the hard, and the soft ground, and is the most extensively used. Lowry, whose merit and success as an artist, have never been excelled, is said to form it with three parts of asphaltum, two of Burgundy pitch, and one and a half of white wax. The asphaltum must be powdered and melted first, and the other ingredients being added as soon as it is in a state of fusion, are thoroughly mixed with it; the whole is then poured out into warm water, and kneaded into balls.

This is an excellent composition: it is adapted to temperate weather: in very cold weather, the proportion of pitch may be a little increased; for very hot weather, it may be hardened by boiling it rather longer, than would otherwise be necessary. If in kneading the etching ground, any part of it should adhere to the hand, it may be entirely removed by a little fresh butter, having first rubbed off the principal part with a towel, after warming the hands at the fire.

For a hard ground, take four ounces of fat oil, very clear, and made of good linseed oil, like that used by painters. Heat it in a clean earthen pipkin, add to it four ounces of powdered gum mastic, and stir the mixture briskly, till the whole be well combined. Then press the whole mass through a piece of fine linen into water, and form it into balls, like the grounds above described. This is the hard varnish used by Callot, and is called the Florence varnish. It answers perfectly well.

The copper-plate for etching, is prepared in the same manner as for engraving with the tool, and it should be cleansed from greasiness by rubbing it with a clean cloth, and Spanish white. To cover it with the ground, it must be heated, as for example, in a common kitchen oven, or by holding it over a chafing dish of burning charcoal. When it is hot enough, a ball of the ground to be used, should be in readiness, tied up in a piece of tiffany, and should be dabbed all over the heated plate, till a sufficient quantity of it is melted, to form a thin coat. That there may be no bubbles, or want of continuity in the ground, which would be fatal to success in the subsequent operations, the ground should be dabbed and united, with a ball of cloth, till it begins to stiffen; and the ground must never be heated so much as to smoke. The next operation is to blacken the varnish, which is done by holding the surface covered with it, over the flame of one or more


ONE
Pattison Limpet Engravers &c.

candles, according to the size of the plate, and moving it about, till every part has been blackened by the smoke. The plate should never touch the snuff of the candle, and as soon as the blackening is complete, it must be left to cool in a place where it will not receive the least dust. The blackness of the ground, renders every stroke made with the needle distinct, from the brightness of the copper, which immediately appears.

To transfer the design to the ground, it must be traced upon transparent paper, as for engraving with the tool, except that a pen and Indian Ink should be employed, instead of a pencil; this ink will easily mark the transparent paper, if mixed with a little ox-gall; another thin piece of paper must then be smeared with red chalk, which should be rubbed on, till it covers the paper equally, and will not easily come off; the chalked side of this paper must be placed flat upon the ground on the plate, and the traced side of the transparent paper must be placed next to it, and both secured from moving, by pieces of wax at the corners. In the distinctness of the design on the transparent paper, there will scarcely be any difference of the sides; and therefore all the lines may be gone over with a blunted steel, or ivory point. On lifting up the papers, a distinct outline will be found upon the ground, in consequence of the red chalk adhering to it, wherever it received the pressure of the point. And as the back of the transparent paper has been traced upon, the design on the ground will be reversed, with respect to right and left, so that the impression of the plate will resemble the original: but if the contrary be desired, it is only necessary to trace upon the right side of the transparent paper. The etching needle must now be used, and lines to form the outlines, and shades, must be traced with it, either by hand, or with the assistance of compasses and parallel ruler, as the case requires; taking care to use different needles according to the fineness, or strength, of the strokes required.

Oval-pointed needles are the most proper for strong strokes. The needles should be held as nearly upright as possible.

The varnish raised by the needle should be removed from the plate frequently, to prevent its stopping up the lines in any part. The whole design being completed, the plate is ready for biting.

Previous to the use of the acid, the plate should be examined, and if any improper strokes have been made, or if the ground be any where broken up, a composition, called the stopping mixture, must be immediately applied to it. This is formed of turpentine-varnish, and lamp-black. It may be applied to the ground, with a brush, or a pencil, and will, when dry, answer the same purpose as the original ground, either for tracing upon with the needle, or wholly to resist the acid.

The design being complete, the plate is surrounded with a border or wall, about an inch high, composed of bees' wax, softened by the addition of one-third of Burgundy pitch, or tallow. The common nitric acid of the chemists, diluted with an equal quantity of water, is now poured upon the plate, to the depth of about half an inch. The acid will speedily begin to act upon the copper, where it has been laid bare by the strokes of the needle, and bubbles will immediately rise

to the surface. These must be immediately cleared away with a feather as fast as they appear, and also such as are observed to adhere in the strokes.

When the faintest parts of the design, are supposed to be sufficiently bitten, the nitric acid is poured off, by a spout left for that purpose at one corner of the border, and only slightly stopped with a separate piece of wax. The plate is washed with water, and all the parts supposed to be sufficiently bitten, are, when dry, covered with the stopping mixture already mentioned. The spout is now filled up, the acid poured on again, and the same operation repeated, till all the shades are sufficiently bitten. The plate, after being washed, is then heated, and some olive oil being poured upon it, the ground is wholly removed with a linen rag, and the plate made clean with the oil-rubber. The dirt which remains in the lines, may be washed out with spirits of turpentine.

No precise direction can be given for the length of time which the acid must remain upon the plate, and the real depth of the biting cannot be known, by examining a plate while the varnish is on it. From half an hour, to an hour, is the usual time for fine work, but a day and even several days is required for some designs. The effect must therefore be ascertained by scraping off a small part of the ground, to examine the plate; or by using a spare piece of plate, upon which a ground is laid, and lines drawn similar to those on the true plate, and trying what time the acid to be used requires, for producing the effect desired. It is, however, to be observed, that the same acid will have different effects on the same copper, in seasons of different temperature, its power being weakened by cold; and even so slight a circumstance as that of the sky becoming overcast, and gloomy, during the operation of biting, will retard the action of the acid.

When the ground is entirely cleared away, and any part is observed to be over-bitten, it may be corrected by rubbing it with the burnisher, if it be slight; but if the excess of biting be considerable, the copper must be rubbed down with charcoal.

When any part of the plate is materially too faint, it may be rebitten, but this is a very delicate and hazardous operation. A little of the etching ground being melted on a spare piece of copper, it may be taken up by the dabber, and dabbed upon the part to be rebitten, in such a manner that it may not enter the former strokes, but merely adhere to the uncut part of the copper. The part is then surrounded with wax, and the acid used in the customary manner. The strokes to be rebitten, must be entirely cleansed from any foulness, by the use of spirits of turpentine, and afterwards rubbing it with the crumb of bread.

The art of etching, in its infancy was considered as a spurious kind of engraving, and those who adopted it, from the facility with which it was performed, were anxious to conceal their use of it, and to give their work as much as possible, the appearance of having been executed with the graver. Hence they used the hard ground or varnish, as it produced the sharpest lines, and was best adapted to their purpose. But when the peculiar excellences of the two arts, was ascertained,

etching was better appreciated, and this concealment was no longer necessary; and therefore the common ground, for general use, has entirely superseded the hard ground, because it admits of so much more freedom in the use of the needle.

Etching, is peculiarly adapted to the expression of all objects which are termed picturesque, such as ancient buildings, cottages, rocks, uneven ground, trees, and verdure in general. This arises from the freedom with which the lines forming these objects may be drawn with the needle, which may be used in the same manner as a black-lead pencil, and also from a certain agreeable roughness left in the strokes when the acid is allowed to bite freely. But etching has also the apparently opposite property, of being well adapted to smooth flat surfaces, of every description. This arises from the uniform action of the acid, in biting the strokes in every part alike, a property in which it can never be rivalled by the graver.

It has been mentioned, that plates, professed to be done with the tool, are scarcely ever executed without some assistance from etching; it may be added, that the copper-plates professed to be etched, are scarcely ever committed to the press, without some touches of the graver, and dry-point. The two arts mutually and essentially assist each other.

(TO BE CONTINUED.)

On the Nature and Properties of Timber, extracted from "The Elementary Principles of Carpentry. By THOMAS TREDGOLD."

(Continued from p. 50.)

ON SEASONING TIMBER.

When timber is felled, the sooner it is removed from the forest, the better: it should be removed to a dry situation, and placed so that the air may circulate freely round each piece, but it should not be exposed to the sun and wind. Squared timber, does not rift, or split, so much as that which is round; and where the size of the trees will allow of it, it is better to quarter them. When beams are to be used the full size of the tree, it would be a good preservative against splitting, to bore them through from end to end, as is done in a water-pipe. It is irregular drying, that causes timber to split, and this method would assist in drying the internal part of the beam, without losing much of its strength; at the same time, it would lighten it considerably.

Duhamel has shown that it is a great advantage to set the timber upright, with the lower end raised a little from the ground; but as this cannot always be done, the timber yards should be well drained, and kept as dry as possible. Paved yards are to be preferred, and the paving should have a considerable fall, to prevent water standing. If the paving were laid with ashes, it would be better; those from a forge or foundry, would be excellent; even an unpaved yard would be improved by a coat of ashes, to prevent any thing growing among the timber.

If timber can be kept some time in a dry situation, before it be cut into scantlings, it is less subject to warp, and twist, in drying; but during the time it is kept in the tree or log, it should be carefully piled, so as to leave space for a free circulation of air between each piece, and also between the timbers, and paving, or ground. Lately, in some of the government yards, the timber has been laid upon cast-iron bearers, instead of being laid upon refuse pieces of wood; as the refuse wood is often half rotten, and must in some degree contribute to infect the sound timber. Timber is too often suffered to lie half buried in the ground, or grown over with weeds, till it be covered with fungus, and impregnated with the seeds of decay before it be brought into use.

When it shall have become convenient to convert the timber into smaller scantlings, it still requires attention; as the better it is seasoned, when brought into work, the better the work will stand, as well as be more durable. The experiments of Duhamel, show, that such scantlings will dry soonest in an upright position, and that the upper end, dries more rapidly than the lower one. But whether the pieces of timber be piled on the end, or laid horizontally, a free space should be left round each piece, and the situation should be dry, and airy, yet not exposed to the direct rays of the sun. If the scantlings be laid horizontally, short blocks should be put between them; which will preserve them from becoming mouldy, and will contribute much towards rendering the sappy parts, more durable.

Gradual drying, where the time can be allowed for it, is the most certain means of giving durability to timber, by fixing those parts of it, which are most liable to be acted upon, by heat, and moisture.

It is well known to chemists, that slow drying will render many bodies less easy to dissolve, while rapid drying on the contrary, renders the same bodies more soluble; besides, all wood in drying loses a portion of its carbon, and the more, in proportion as the temperature is higher. There is, in wood that has been properly seasoned, a toughness and elasticity which is not to be found in rapidly dried wood. This is an evident proof that some essential parts are dissipated in a high heat. Also, a forced seasoning, produces a hard crust on the surface, which will scarcely permit the moisture to evaporate from the internal part, and is very injurious to the wood.

For the general purposes of carpentry, timber should not be used in less than two years after it is felled; and this is the least time that ought to be allowed for seasoning. For joiner's work, it requires four years, unless other methods be used; but for carpentry, natural seasoning should have the preference.

Duhamel says, that the quantity of matter which ought to be evaporated from green oak, is about one-third, or two-fifths of its weight; the proportion, however, will vary according to the age, and quality of the timber, and the nature of the soil that produced it. I shall attempt to establish the relation between the size of the pieces, and the time necessary to season them, in a succeeding article, as it is a subject that has not received that share of attention, which its importance merits.

Water Seasoning.—On account of the time that it requires to season timber in the natural way, various methods have been tried to effect the same purpose in a shorter time. Perhaps the best of these is, to immerse the timber in water, as soon as it is cut down; and after it has remained about a fortnight in water, but not more, to take it out, and dry it in an airy situation.

Evelyn directs, to lay your boards a fortnight in water (if running, the better, as at a mill-pond head) and then setting them upright, in the sun and wind, so as it may pass freely through them, turn them daily; and, thus treated, even newly-sawn boards, will floor far better than those of a many years dry seasoning, as they call it;" and he adds, "I the oftener insist on this water seasoning, not only as a remedy against the worm, but for its efficacy against warping and distortions of timber, whether used within, or exposed to the air."

Duhamel, who made many experiments on this important subject, states, that timber for the joiner's use, is best put in water for some time, and afterwards dried; as it renders the timber less liable to warp, and crack in drying; but, he adds, "where strength is required, it ought not to be put in water." And he found, from numerous experiments, that timber which had remained some time in fresh water, lost more of its weight in drying, than that which was dried under cover; and he observed, that green timber that had been steeped in water for some time, was always covered with a gelatinous substance.

Timber that has been cut when the tree was full of sap, and particularly when that sap is of a saccharine nature, must be materially benefitted by steeping in water; because it will undoubtedly remove the greater part of the fermentible matter. Duhamel has ascertained that the sap-wood of oak, is materially improved by it, being much less subject to worm-eat; and also, that the tender woods, such as alder and the like, are less subject to the worm, when water seasoned. Beech is said to be much benefitted by immersion; and green elm, says Evelyn, if plunged four or five days in water (especially salt-water) obtains an admirable seasoning.

When timber is put in water, it must be sunk so as to be completely under water, as nothing is more destructive than partial immersion. Salt water is considered best for ship-timber, but for timber to be employed in the construction of dwelling-houses, fresh water is better.

Of Steaming and Boiling Timber.—Though steaming, or boiling, impairs the strength and elasticity of timber, it gives another property, which for some purposes, is still more desirable than strength; for boiled, or steamed timber, shrinks less, and stands better, than that which is naturally seasoned. Therefore it may often be useful to season timber in this manner, where joiner's work is to be executed in oak of British growth, as without this precaution, it requires a long time to season it, so as to be fit for such purposes.

The timber should not remain long in boiling water, or steam; four hours will, in general, be quite sufficient: and after boiling or steaming, the drying goes on very rapidly, but it is well not to hasten the drying too much. Steamed wood, dries sooner than that which is boiled, according to Mr. Hookey's experiments.

How far steaming, or boiling, affects the durability of timber, has not been satisfactorily ascertained; but it is said, that the planks of a ship, near the bows, which are bent by steaming, have never been observed to be affected with the dry rot. The changes produced by boiling, as observed by Duhamel, are not very favourable to the opinion, that it adds to the durability of timber. For when a piece of dry wood was immersed in boiling water, and afterwards dried in a stove, it not only lost the water it had imbibed, but also a part of its substance; and when the experiment was repeated with the same piece of wood, it lost more of its substance the second time, than it did the first. The same thing takes place in green wood; and tender woods, or those of a middling quality, are more altered by these operations, than hard woods, or those of a good quality. Dr. Watson found steeping long in cold water, produced similar effects; and that box, oak, and ash, lost more weight by this process, than mahogany, walnut or deal.

Of Smoke-drying, Scorching and Charring Timber.—It is an old, and a well founded observation, that smoke drying, contributes much to the hardness and durability of wood. Virgil seems to have been aware of its utility, when he wrote the passage which is thus translated by Dryden:

> "Of beech, the plough-tail and the bending yoke,
> Or softer linden *hardened in the smoke.*"* *Georgics*, I. 225.

But this method can only be effectually applied on a very small scale; yet sometimes, for particular purposes, it may be useful to season in the smoke. As a substitute for the smoke of an open chimney, Ellis advises to burn fern, furze, straw, or shavings under the timber, which would destroy any seeds of fungi or worms, and so embitter the external surface as to prevent any future ill effect from either. It would be easy to contrive the means of smoke-drying, for the use of a manufactory, where much seasoned wood was used.

Scorching must do timber much harm when it is done hastily, so as to cause rents and cracks in it; as these become receptacles for moisture, and consequently must be the cause of rapid decay.

It must be always remembered, that charring the surface is only useful in as far as it destroys and prevents infection; and that it should be applied only to timber already seasoned; for when it is applied to green timber, it only closes up the pores at the surface, so that the internal sap and moisture cannot evaporate.

In that kind of decay which arises from the constant evaporation of moisture, charring the surface produces no effect. Duhamel made some experiments on this point, and found that there was very little

* Beckman (in his history of inventions, vol. 2. p. 77) quotes a passage from Hesiod to the same effect; and adds, "as the houses of the ancients were so smoky, it may be easily comprehended how, by means of smoke, they could dry and harden pieces of timber." In this manner were prepared the pieces of wood destined for ploughs, wagons, and the rudders of vessels:

> "These long suspend, where *smoke* their strength explores,
> And seasons into use, and binds their pores." *Sotheby's Virgil.*

difference between the posts he had charred, and those he had not charred, at the end of six years; but as a preventive of infection by the dry rot, and of the worm in timber, charring appears to be very beneficial, and will no doubt be assisted by impregnating the timber with the bitter particles of smoke.

Tables of the weight of Timber in different States.

As a suitable introduction to some remarks on seasoning, I subjoin the following tables.

Weight of a cubic foot of Timber, Green, and also its weight a year afterwards.

From Duhamel's experiments; reduced to English Weights and Measures.

Kind of Wood.	Weight of a cubic foot green	Weight of a cubic foot one year afterwards.
Oak of Provence	78.25	68.3
Elm, ditto	57.14	47.5
Poplar, ditto	49.68	30.69
Walnut, ditto	54.43	44.08
Lime, ditto	45.2	27.96
Beech of Bourgogne	56.25	43.95
White pine of Provence	53.73	43.93
Norway pine, dry		36.75

The writer of an article on Timber, in the Encyclopedie Methodique, states that the weight of a cubic foot of green oak varies from 62.5 to 66 pounds; of a cubic foot of seasoned oak, from 53.5 to 58 pounds; and a cubic foot of very dry oak, from 44.6 to 47.3 pounds. The timber of very old trees is often much lighter than this; I have tried specimens from old trees that did not exceed 38.5 pounds per cubic foot when dry. When the specific gravity is very low it may be safely concluded that it is the wood of an old tree, and that it will be brittle, and deficient both in strength and toughness.

Some experiments have been made on the loss of weight in seasoning by Mr. Couch, at the Royal Dock Yard, at Plymouth, from which the following are taken.

Kind of Wood.	Weight when felled of a cubic foot.	Weight seasoned of a cubic foot.	Shrinkage in seasoning.
	pounds.	pounds.	
Oak (butt end)	69	$47\frac{1}{2}$	$\frac{1}{32}$
Elm	$58\frac{1}{2}$	$56\frac{1}{2}$	$\frac{1}{44}$
	Weight of a cubic foot when first imported.		
Riga masts	42	40	$\frac{1}{72}$
Pitch pine, American	47	$46\frac{1}{4}$	$\frac{1}{46}$
Yellow pine, ditto	$42\frac{1}{2}$	$28\frac{3}{4}$	$\frac{1}{114}$
Spruce pine, ditto	33	$32\frac{3}{4}$	$\frac{1}{112}$

To these experiments the following new ones are added, which include some varieties of wood not before tried.

Kind of Wood.	Weight of a cubic foot when green.	Weight of a cubic foot dry.
	pounds.	pounds.
Oak sap-wood (quercus sessiliflora)	67.0	47.07
Spanish Chesnut	54.68	37.91
Larch	42.06	30.99
Walnut	57.5	38.5
Acacia (robinia pseudo-acacia)	51.25	46.76

We are also indebted to Mr. Wiebeking for some experiments on seasoning timber; and as both the kinds of timber and the times of observation are different from those already noticed, his table is a considerable addition to our knowledge of this important subject. It is, in common with all the other tables in this work, reduced to English weights and measures.

Weight of a cubic foot of wood in different states.

Kind of Wood.	Weight of a cubic foot fifteen days after the wood was felled.	Weight of a cubic foot after 3 months' exposure to the air.	Weight of a cubic foot when dry.
	pounds.	pounds.	pounds.
Oak	58.74	56.18	39.27 to 39.58
Larch	53.63	51.08	38.31
Pine (pinus sylvestris)	51.08	38.31	26.817
Pinaster	52.35	33.2	25.54
Fir (pinus picea)	33.2	29.37	25.22 to 25.54

Wood, when it is cut into small pieces, very soon acquires its utmost degree of dryness. Dr. Watson, Bishop of Llandaff, in the month of March, cut a piece from the middle of a large ash tree that had been felled about six weeks, and weighed it; its weight was 317 grains; in seven days it lost 62 grains, or nearly one-fifth of its weight. It was weighed again in August of the same year, but had not lost any more of its weight; hence it had become perfectly dry in the short space of seven days. He also found that the sap-wood of oak lost more weight in drying than the heart-wood, in the proportion of 10 to 7.

Mr. Pontey has ascertained that the sap-wood of larch loses two-fifths of its weight in drying.

(TO BE CONTINUED.)

Practical Observations and results, in the Manufacture of Iron from the ore into blooms, in Shropshire. By ARTHUR AIKIN, *Esq. Secretary to the Society for the encouragement of Arts, Manufactures, and Commerce, &c. &c.*

Society of Arts, &c. &c. Adelphi, Nov. 22, 1825.

Dear Sir,—Perceiving in the *Technical Repository* many interesting practical communications respecting Iron and Steel, the following

particulars may, perhaps, not be unacceptable. They are the result of enquiries made by me, some years ago, *under very favourable circumstances*, respecting the practice pursued at a large Iron Smelting Work in Shropshire; and which, at that time, produced some of *the best Iron* in the English market.

I am, Dear Sir, yours,

T. Gill, *Esq.* Arthur Aikin.

Process of Puddling Iron, as practised at the Lightmore Works, in Shropshire.

The different stages of the manufacture, from the ore to the making blooms, are, briefly, the following:—

1. The roasted ore, being mixed with limestone, is reduced in the *high smelting furnaces*, (with coak,) which are *tapped* at regular intervals; and the melted iron runs into furrows, made in sand, and thus forms *pigs*.

2. The pigs, being broken into two or three pieces each, are remelted in the *refinery furnace*, (with coak) and the produce being let out into a shallow, flat, cast-iron trough, forms thick plates, called *slabs*.

3. The slabs being broken, are melted in the *puddling furnace*, (with coal,) and brought out in large masses, called *balls;* which, while yet glowing hot, are;—

4. Laid under a very heavy hammer, and *stamped* into *plates;* which are then thrown into water, in order to cool them.

5. The plates being broken, the pieces are piled one on the other, to the height of about a foot and a half, and placed in a *reverberatory furnace*, called a *balling furnace*; from which, when sufficiently heated, (by coal) they are removed to the *shingling hammer*, where they are beaten into short, thick bars, called *blooms*.

The following are the particulars observed during the process of Puddling.

The furnace employed is a *reverberatory* one, of very simple construction, and the fuel used is coal. The flat area of the furnace being previously covered with sand, the charge was put in, consisting of 3½ *cwt.* of broken slabs, which were heaped up loosely in the middle of the furnace. The door was then carefully closed, and the full force of the flame was let on. In about half an hour the door was opened, and the glowing metal being partly fluid, the workman was engaged in breaking and spreading it for about five minutes, water being thrown on occasionally in small quantities, by a scoop, and being immediately succeeded by much ebullition, and the disengagement of copious jets of white light. The spreading being completed, the door of the furnace was again closed, and the flame turned on for two or three minutes. The door was then opened, the flame turned partly off, and the charge worked by incessant stirring; a few wet scales of iron, and water in small quantities, being occasionally added: the charge now began to grow pasty, and to adhere to the tools. The fire was still further damped, and water, in small portions, was frequently added; the mass being incessantly worked with great vigour: the jets of flame were very copious, and the metal still pasty, and ad-

herent to the tools. The working of the mass was still continued, but without the addition of water; and soon after the metal began to lose its coherence; more water was then added, and the breaking down of the metal proceeded rapidly; it still, however, adhered more or less to the tools, till it was reduced to the consistence of coarse gravel; at this period, the jets of white light were succeeded by a heavy red vapour, indicating the necessity of more heat: the full force of the flame was then let on, the door of the furnace continuing open, and the workman adding water, and stirring the mass incessantly; the jets of white light reappeared, the metal became of the consistence of coarse sand, and began to *come into nature*, i. e. *to clot*. The iron now burned rapidly, with an intense white light, upon which the fire was damped a little; the metal was every minute becoming more cohesive, it was of a glowing white, and burnt away very fast; water, in small quantities, was still added. The metal was now of a pasty consistence, and did not adhere to the tools: *it was come completely into nature;* and was made up into several lumps; one hour and a half being expired, from the first charging the furnace.

The door of the furnace being now closed, the full force of the fire was let on for two or three minutes; after which, the door being opened, and the flame damped, the lumps were *dollyed*, i. e. compressed and beaten with a heavy iron mace; and were made up into five nearly equal balls; one hour and three quarters being now expired.

The balls, glowing hot, were then removed from the furnace to the *stamping hammer*, where they received from 70 to 100 blows each, and were thus formed into rough plates; being then cooled in water, they were weighed, and amounted, in the whole, to two hundred weight, three quarters, and nineteen pounds, or nearly 86 per cent.

The following Answers to Queries addressed by me to the manager of the Works, cannot but prove interesting.

On Roasting the Ore.

Query 1.—How much coal, and of what kind, is employed in roasting the ore, per ton?

Answer.—Five hundred weight. We used small coal from the pits.

Query 2.—How much time does this process require?

Answer.—It may be done in a week, in small quantities; but it is better done, and much cheaper, in large quantities.

Query 3.—What loss of weight does the ore undergo?

Answer.—Nearly one fourth.

On Making Coal into Coak.

Query 4.—What kinds of coal are made into coak?

Answer.—All the kinds, excepting the *stinking coal*, (that abounding in pyrites,) but *top coal* makes the best.

Query 5.—What time does the process require?

Answer.—From five, to seven or eight days.

Query 6.—What is the loss of weight in converting coal into coak?

Answer.—One half.

On the Limestone employed in Smelting.

Query 7.—What are the different varieties of limestone that are employed?

Answer.—The Wenlock and Littleshall.

Query 8.—Why is the Littleshall reckoned the best?

Answer.—Less weight of it, is said to flux more ore; and it comes cheaper than the Wenlock.

On Smelting the Ore.

Query 9.—What are the relative proportions of *Penny-stone* and *Spar-stone*, (the two varieties of iron ore, used at the works?)

Answer.—We mix about one-twelfth of spar-stone with penny-stone.

Query 10.—What proportion of limestone is employed?

Answer.—About ten hundred weight of Littleshall. Rather more, if the Wenlock stone is used.

Query 11.—What proportion of coak is employed?

Answer.—Forty-five hundred weight to a ton of iron, on an average of the different kinds.

Query 12.—The number of runnings, and weight of metal obtained in twenty-four hours?

Answer.—Two runnings, and about seven tons of Iron, if for forge-pigs; not more than six tons, if for melting pigs. This depends upon the size of the furnace.

Query 13.—How much roasted ore is required for a ton of iron?

Answer.—Forty-five hundred weight is the general calculation: but we worked at forty-two hundred weight to a ton.

On Pig Iron.

Query 14.—The names, external characters, and properties of pig iron?

Answer.—*Gray*, *white*, *smooth*, and *honeycomb* pigs. The smooth-surfaced pigs are highly blown, and are used for melting into castings. The honey-combed pigs are used for forge-iron.

Query 15.—On what circumstances do the varieties in pig-iron depend?

Answer.—The smooth surfaced pig-iron, has had more blast in a given time. Farther than this, I cannot say. It would have been a very valuable circumstance to us to have been able to answer this question more satisfactorily.

Query 16.—Does Littleshall limestone afford better iron than Wenlock limestone.

Answer.—I do not imagine that the experiment has ever been made; but I can say, that we have worked for months together, with Wenlock limestone, and have had as good iron, as when the Littleshall was used.

Query 17.—What effect has the temperature, and the dryness or moisture of the air, on the smelting; and on the quantity or quality of produce?

Answer.—In cold and dry weather, we had more and better pig-iron, than when the air was hot and moist. I regret that this question cannot be answered in a better manner.

On Refining the Iron.

Query 18.—Are not the different qualities of pig-iron mixed in certain proportions, in the refining?

Answer.—They are, sometimes; but the refined iron is generally of a better quality, when the pig-iron is all of one sort, viz. with a honey-combed face, and with an open, bright gray fracture.

Query 19.—What is the produce in refined iron *(slabs)* per ton, of pig-iron?

Answer.—Sixteen hundred weight, two quarters, and twelve pounds. The workmen are expected to produce a ton of slabs for every twenty-four hundred weight of pig-iron.

Query 20.—The quantity of coak used for each ton of slabs?

Answer.—Seven hundred weight and two quarters.

Query 21.—The time required for the process?

Answer.—Two hours.

Query 22.—What are the external characters and properties of good slabs?

Answer.—A honey-combed surface, and a bright, silvery, glistening fracture.

On Puddling and Stamping the Iron.

Query 23.—What is the produce of stamped iron per ton, of slabs?

Answer.—Seventeen hundred weight, one quarter, and sixteen pounds. The workmen are expected to produce a ton of stamped iron, for every twenty-three hundred weight of refined iron, or slabs.

Query 24.—How much is required in the preparation of one ton of stamped iron?

Answer.—About twenty-five hundred weight.

On the Blooms.

Query 25.—What is the produce in blooms per ton, of stamped iron?

Answer.—About sixteen hundred weight, three quarters, and ten pounds. This was our average quantity in two years.

Query 26.—How much coal is used in the preparation of one ton of blooms?

Answer.—About twenty-two hundred weight.

Query 27.—What are the external characters and properties of good blooms and bad ones?

Answer.—Good blooms should be of a bright lead colour, and should break wiry and tough. Bad blooms are of a dirty red colour, and break short.

The following is a tabular arrangement of the ingredients and produce of each operation, calculated on one ton of blooms. The numbers express cwts. and their decimal parts.

91.41 raw ore	+	22.85	small coal produce	68.73 roasted ore.		
68.73 roasted ore	+	147.28	coal, (73.64 coak)	+	17 limestone	= 32.73
pig iron.						
32.73 pig iron	+	20.46	do. (10.23 coak)	- - - - -		= 27.28
refined.						
27.28 refined iron	-|-	2965	- - - - - - - - - - - - - - -			= 25.73
stamped.						
23.73 stamped iron	-|-	22. 0	- - - - - - - - - - - - - - -			= 20.
blooms.						
		242.24				

[*Tech. Rep.*

On the Mineral History of Gold, and on the separation of it from Earthy and Stony bodies by water, Mercury, &c. By the late WILLIAM LEWIS, M. D.

Gold is found in its perfect metallic state, sometimes in masses of considerable magnitude, more frequently in dust or minute grains, intermingled among earths and sands, or in little drops and veins, bedded in different coloured stones, which strike fire with steel, and are not soluble in aqua-fortis. It is never debased into a true ore, as other metals generally are, by the coalition of arsenical or sulphureous bodies; though it is often very intimately combined in the composition of sands and stones, and blended in small proportion, with the ores of other metals. It is scarcely ever free from some admixture of other metals, particularly of silver. Cramer observes, that such as is found loose in earths and sands, generally contains more silver than what is lodged in a solid matrix. To such an admixture is apparently owing the paleness of some kinds of gold; and probably the Malaccasscan gold, said by Flacourt in his history of Madagascar, to be not only paler, but much more fusible than that of Europe, and which has hence been supposed by some to be in its own nature distinct, is no other than a mixture of gold with a certain quantity of silver: it is said to be of considerably less value than the European gold, from which circumstance, (omitted by Boyle and others, who have quoted Flacourt's account,) it may be presumed that it is not regarded upon the spot as being pure gold.

The Brazils, the Spanish West Indies, some parts of the East Indies, and the coast of Africa, afford the largest quantities of gold. Some parts of Europe, also, appear to be rich in this metal: the mines of the Upper Hungary, which seem to be the most considerable in this quarter of the world, have continued to yield gold for upwards of ten centuries.

Peru, Mexico, Chili, and other provinces of the Spanish West Indies, abound with gold, in a variety of forms. It is found both in the sands of rivers, and in mines; intermixed with loose earth, lodged in fissures of rocks, and bedded in hard stones; at the surface of the earth, and at great depths; in dust, in grains, like the seeds of apples, called *pepitas*, and sometimes in considerable masses of an extraordinary size. Reaumur reports, that a piece was shown to the French academy, which was said to weigh fifty-six marcs, or four hundred and forty-eight ounces; and Feuillée says he saw one in the cabinet of Antonio Portocarero, which weighed upwards of sixty-six marcs, or five hundred and twenty-eight ounces. Both these pieces were assayed, and found to be of different fineness, in different parts of the mass; the first was, in one part, twenty-three carats and a half; in another, twenty-three; and in another, only twenty-two: the second was, in one part, twenty-two carats; in another, twenty-one; and in another, but seventeen and a half. It is, however, rare to meet with masses, of the weight even of an ounce; the largest in the British Museum weighs but fifteen penny-weights. Notwithstanding the ex-

tensive dissemination of it through those provinces, yet the quantity of the gold, in proportion to the earthy and stony matter mixed with it, appears to be in general exceeding small. According to Frezier, in his voyage to the South Sea, and Captain Bretagh's account, printed in Harris's collection, the common yield is no more than five or six ounces of gold, upon the caxon, or fifty hundred pounds of the mineral: the richest mines afford only ten or twelve ounces; and those which are but just rich enough to pay the charges of working them, yield only two ounces on that quantity. It may be observed, in general, that the quantity of gold in minerals is more variable than that of other metals in their ores, and the profits of a gold mine more precarious; this metal not being formed in any regular veins, or uniformly distributed through any particular kind of earth or stone, but scattered, as it were, here and there, through different mineral bodies: when united with other metals in their ores, its proportion is by no means constant; though, in this case, it is subject to much less variation than when it is barely bedded in earths or stones.

Of the source of the gold in the East Indies and of Africa, we know but little. From Cape Coast, on the coast of Africa, we receive yearly between two and three thousand ounces of gold dust, which is supposed to be collected from the sands of rivers; and some European traders are said to have been witnesses of the richness of the sands in certain parts of that coast. In Hooke's posthumous papers, an account is given of a person having met with great quantities of gold, in the sands of one of the rivers; the sand seeming to grow richer and richer as he advanced further up: in some places, he says, he gained sixty-three grains of gold from five pounds of sand; and he seems, afterwards, to have met with much more profitable spots. Three or four hundred ounces, as I am informed, are collected yearly from the sands of the Gambia, and cast into bars at James Fort, one of our settlements on that river.

It is said that the gold dust from Africa, in its purest state, is from twenty-one to upwards of twenty-two carats fine; but that the natives frequently mix with it filings of brass. This mixture may be distinguished by the hydrostatic balance, the specific gravity of brass not being half so great as that of the gold dust: in this way of examination great care must be taken to make the water penetrate as perfectly as possible into all the interstices, so as to come into close contact with every particle. A little aqua fortis also, poured on the mixture will immediately discover the fraud, receiving from the copper in the brass a blue tinge. It has been suspected, that if the gold be naturally alloyed with a little copper this trial will prove fallacious, and that the natural copper will tinge the menstruum equally with that which is added by art: of this, however, there is no danger, the natural alloy not being in distinct particles, but diffused through each mass or particle of the gold, so as to be covered by the gold, and protected from the action of the menstruum. There are several other means by which this abuse may be discovered: if the dust be spread thin on a piece of white paper, and moistened with any volatile alkaline spirit, as that of hartshorn, of sal-ammoniac, or of wine, the spirit will,

in a few minutes, dissolve so much of the copper as to stain the paper blue: stale urine itself has a like effect in an inferior degree; and a solution of crude sal-ammoniac, applied in the same manner, produces a greenish stain.

(TO BE CONTINUED.)

On the liability of the English Silks and Cottons to become faded; and on the superiority of the Silks of France and the Cottons of India in that respect. By Mr. THOMAS ALLSOP.

Madras, Sept. 5, 1825.

SIR—Among the queries submitted in my letter to you of the 28th September last, was one, requesting to know "why English silks or satins do not retain their colour, or whiteness, so long as those of French manufacture?" I believe the cause cannot reasonably be attributed to the change of climate, as in that case I think it should equally affect both:—but that of French manufacture will be found as perfectly fit for use, after a period of twelve or fifteen months, as when first imported; while the English silks, or satins, (particularly *white*,) will have so completely changed as to be rendered useless for any article of dress, &c. The white will have assumed an unsightly *yellow tinge*, and those coloured will be found to have faded considerably. Although I have no pretension to any great knowledge of chemical science, I am led to imagine, that the fault originates, in a great measure, from the method used in extracting the varnish or gum, from the raw silk; and perhaps, also, from some slight inattention in the process of bleaching it afterwards. I think it will be readily acknowledged, by even the most profound chemists, that any article, particularly so delicate a one as silk, must suffer, either more or less, by exposure to the action of sulphurous acid gas, or immersion in acid, according to the degree of strength or purity of the ingredient used, as well as by the length of time the article is submitted to the action of the gas, or remains in the acid. It is, however, for those who are better qualified in this useful science to determine this material point.

The silks manufactured here are all of an imperfect white, but I believe last much longer than the English or French. The coloured silks are scarcely inferior, and stand as well as the best I have ever seen. The scarlet, purple, orange, and other coloured silk shawls, from Bangalore, are really beautiful, and the colours permanently fixed: their colours, mordants, apparatus, and processes altogether, are simple and cheap: their knowledge of chemistry but very contracted. Still, with all these apparent disadvantages, they produce articles vying in point of quality and texture even with the most refined nations in the universe.

It is also worthy of remark, that the English long-cloths, muslins, jaconnets, &c. never retain their original whiteness for any length of time, but assume a yellow tinge, like the silks and satins above mentioned;

nor do they regain it, by any process of washing. Some pieces, after a few washings, are full of small holes, and it is an incontestible fact, that one piece of good Northward 36 Penijum, will wear out three pieces of the best English long cloth. No deleterious ingredient is used by the natives to give their cloths an artificial whiteness—no chemical process is used by them. The cloths are delivered from the loom in their original state, dirty and brown; but when returned from the washerman, or *vunha*, are as white as snow. The only advantage then, is, (if it may be called an advantage,) that the English cloths are much cheaper, and upon minute examination the threads will be found of a more even texture, and more regular, than those of this country. These are certainly advantages; and if some little attention were to be paid to the usual mode of bleaching, by expunging the articles likely to tinge or corrode the cloths, there is no doubt but that English cottons and linen will be of much greater consideration, and in more request, than they are at present.

I do not know how far I am correct in remarking, that I consider the mode in which the bales of cotton for exportation are generally packed, may in some measure, account for the evils above mentioned. I have seen them, and indeed, it is the general custom to compress a considerable quantity of cotton into a very small compass. This is effected by means of strong massive iron frames, and powerful screws of the like metal; so that when the cotton is removed, for the purpose of being packed in gunnies, &c. it is found to be almost a solid mass. Although much space may be saved thereby, on shipboard, and consequently freight money, I should imagine that the cotton must be in some way injured. If this be really the case, and I have but little doubt myself but it is, the natives here have decidedly a very material and obvious advantage in the manufacture of cloths.

I could say much more upon this subject, but it would be a further digression from the intention with which I commenced this letter. I shall therefore briefly state, that my motive for submitting the question alluded to in the first paragraph, originated from the circumstance of my having purchased, about eight or ten months previous to the date of the above letter, a roll of white satin, and after such quantity as was immediately required had been cut off, (which was only a few yards,) the remainder was carefully put by for a future occasion, which however did not occur until about the time mentioned, when I found the colour had changed to a dirty yellow. The silk was rendered completely useless!

I hope that the queries in my last will meet the attention of some of your valuable and scientific correspondents, who may favour me with the required information.

Accept my best thanks for your prompt attention to my communications, and believe me to remain,

Sir, yours truly,

THOMAS ALLSOP.

To T. GILL, Esq.

[*Tech. Rep.*

On a mode of preparing Etching-ground for Engravers. By Mr. EDMUND TURRELL, *Engraver. Abstracted from a paper in the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.*

All engravers are aware of the importance of obtaining a good etching ground. Many recipes have been published, to choose from which requires considerable experience; and when the recipe is good, failures frequently occur from the materials not being good, or from an improper mode of compounding them. To obviate these difficulties is the object of this paper.

Asphaltum is the most important material, as we know of no substance which will completely supply its place. Asphaltum, or Jews' pitch, is a solid mineral bitumen, supposed to be formed from inspissated mineral tar. There is an artificial asphaltum obtained from the manufactories of coal gas in London, which bears a strong resemblance to the genuine kind, and which answers equally well for many purposes. but not for etching ground.

There is some difficulty in distinguishing between these two articles; they resemble each other in their fracture; that produced from coal, however, is of a deeper black than the natural, the best of which is of a fine deep dark brown colour. If a small piece of the artificial kind be laid upon a hot iron, the vapour will resemble that produced by a piece of coal similarly situated, and a coaly cinder will remain behind. The smell produced in this instance is very nauseous, as both sulphur and ammonia, are disengaged and may be distinguished. When a small piece of genuine Syrian asphaltum is placed upon a hot iron, it will, if very pure, be nearly all converted into vapour, and the smell is by many persons, considered to be agreeable. The essential oil of turpentine dissolves it completely, and forms a liquid varnish, which resists the action of dilute nitrous acid; and which is therefore used by many engravers, to cover those lines, which, in the process of etching, have been sufficiently bitten in.

The above-mentioned properties of resisting the action of dilute nitrous acid, and its capacity of giving hardness and toughness to etching-ground, render it an ingredient of the very first importance. Burgundy pitch stands next in importance. This is obtained from the *pinus abies*, or Norway spruce fir-tree. The best kind for making etching-ground, is sold in bladders; and when perfectly good, is of an opaque yellow, rather darker than straw colour: by age it becomes dark coloured, and so brittle, as to be rubbed down between the fingers, which renders it much less fit for the engraver's use.

The third and last article is virgin wax. Much of that offered for sale is adulterated with suet, which spoils it for the purpose of making etching-ground, as it destroys its adhesive property. Wax thus adulterated, is soft and clammy to the feel, and is less transparent than when pure. If the surface of fine wax be rubbed with a linen cloth, it will take a much brighter polish than that which has grease in it. When cut into thin shavings with a sharp clean knife, a fine

polish will be left upon the cut surface, whilst it will be dull in proportion to the quantity of suet with which it may be contaminated.

These three are the only ingredients necessary to make good etching-ground. Good asphaltum must be had at any price; the other two can be obtained without difficulty.

General directions for preparing and compounding the ingredients above named.

The asphaltum must be broken into small pieces, and if any pieces of clay or other impure matter are observed, they must be carefully taken out, and then it must be ground very fine in a marble or Wedgwood-ware mortar; and while it is under this process, if any hard stony material is discovered, it must be carefully taken out; it will then be ready to be mixed with the other materials, in the following manner.

Put four ounces of Burgundy pitch into a well glazed pipkin; let it melt gently over a slow fire, and move the pipkin round, so that the whole internal surface may be covered with the melted pitch. Then add four ounces of the ground asphaltum, and let the pipkin remain upon the fire until the two substances are tolerably well mixed, which will soon be effected if the mass be well stirred. Then add four ounces more of the asphaltum, and if the heat be increased, and the mass well stirred, the whole may be incorporated, and will be nearly as fluid as melted pitch.

When the asphaltum appears to be thoroughly melted, it should be kept in that state for at least a quarter of an hour, the heat being a little lowered, but it must be stirred all the while, by which means a large portion of the moisture of the Burgundy pitch will be evaporated; and the essential oil of the pitch will be thoroughly incorporated with the asphaltum, and render the etching-ground more perfect; for, when this is omitted, evaporation takes place from the ground when spread upon the plate, after it has been laid on for a month or more, and sometimes in a shorter time, a circumstance which very often produces considerable difficulty to engravers, because when that takes place, the ground is rendered brittle, and frequently chips or flies from the plate, to the great detriment of the tints or lines ruled upon it. When the asphaltum and Burgundy pitch are thus prepared and incorporated, add six ounces of the best virgin wax, and keep the whole well stirred till it is completely mixed, and let it simmer gently for about ten minutes, when it may be taken from the fire, and suffered to cool until it is of the consistence of turpentine, or very thick treacle, and in that state it may be poured out upon the clean surface of a copper-plate, or well glazed earthenware dish, in portions sufficient to make a ball, which may in general weigh about an ounce, and when it is sufficiently cold, it must be rolled up into balls by the hands, and kept perfectly clean for use, provided it is found upon trial to be of the proper consistence, but this cannot be judged of until it has been laid upon the plate for a few hours. If it is too soft the etching point will make the lines of unequal breadth, or, as they are technically

called, will be drag-lines, being in some parts very fine, and in others very gouty or thick. If it is too hard, the etching point will cause the lines ruled on the ground to chip, and then the edges will be notched or serrated, which would be very prejudicial to the appearance of fine even tints.

There is also another property that may be wanting where the proportions are not properly adjusted, namely, that of spreading kindly on the copper-plate. This fault in ground may be easily remedied, by the addition of a proper quantity of Burgundy pitch.

As each of the evil qualities above-named are likely to happen, on account of the different properties of the materials: and as, on that account, *general principles* or directions will be much more acceptable than mere arbitrary recipes, I shall now endeavour to lay down such *general rules*, that when either of the faults before described occur it may be immediately remedied.

In the first place, asphaltum makes the ground hard and tough, therefore if it wants that quality, more asphaltum must be added, but it must be previously dissolved in a proper proportion of Burgundy pitch, for otherwise it will be very difficult, if not almost impossible to get it thoroughly incorporated, after the virgin wax has been added. The propriety of this caution will be evident, when it is considered that Burgundy pitch is the *real solvent* for the asphaltum, and must therefore at all times be incorporated with it first; and for this reason it will always be the best way to make the ground rather too hard than too soft, because it is much easier to soften it than to make it harder.

Should the ground, upon trial, be found too hard, a small quantity of virgin wax may be added, which is all that is necessary to answer that purpose.

If, upon trying to lay it upon the copper-plate, it does not spread kindly, but clings to the dabber, and only partially covers the surface of the copper, this fault may be remedied by adding a small quantity of Burgundy pitch; but should this property prevail, and the ground also appear upon trial too soft, then Burgundy pitch and asphaltum must both be added, after they have been thoroughly incorporated together; for the principal circumstance to be attended to in making etching ground, is completely to dissolve the asphaltum; for although all the recipes I have read or heard of, direct the Burgundy pitch to be added *last*, yet I am convinced, from much experience, that as Burgundy pitch is the true solvent for asphaltum, these two ingredients should be first thoroughly mixed, by which means only can the real and beneficial effects of the asphaltum be fully obtained.

From what has been stated above, the following general rules or principles are deduced:

First, that asphaltum gives hardness and toughness to etching ground, and is indispensably necessary, on account of its valuable property of resisting the action of dilute nitrous acid.

Secondly, that Burgundy pitch acts as a perfect solvent for the asphaltum; and, when mixed, acts also as a vehicle to spread the ground over the surface of the copper-plate, a property essentially necessary to prevent foul biting.

Thirdly, that virgin wax assists in softening the ground, and giving it such a consistence, that when lines are cut through it by the etching point, the edges of each line will be extremely clear and free from flaws or chips, which would be destructive of the beauty expected from the etchings of the present improved state of the art of engraving.

I beg leave to observe, in conclusion, that my principal object in this communication, is to lay before my brother artists the result of several years experience, gained by careful practice, rather than submit to them novel experiments or arbitrary recipes which fix no useful or general principles in the mind, without which every attempt to modify or alter the composition, must be attended with uncertainty, and too frequently with disappointment.

ENGLISH PATENTS.

Patent granted to JAMES KAY, *of Preston, Lancashire, for machinery for preparing and spinning flax, hemp, and other fibrous substances, by power.* Dated July 26, 1825.

The preparation of the flax used by the patentee is to macerate it in water as it is drawn out in slivers, previous to being spun. For this purpose he uses the common machine for drawing out the flax into narrow slivers; but instead of passing it to flys and bobbins for spinning, he places long narrow cans to receive it, which convey it into perforated vessels, into which they fit, and which are fixed in troughs containing water. When the slivers of flax are coiled up in the cans by the action of the machine, they are pressed down by a sort of pistons or rammers into the water, till all air is separated from between the fibres; and when the lower vessels are full, they are separated from the cans, and after being left for six or more hours, for the flax to macerate, are taken to the spinning machines, where their contents are transferred into other troughs, by turning them upside down, and the ends of the slivers being then placed between the rollers, are spun in the usual manner.

The spinning machines differ only from those in use in having the retaining rollers placed much nearer to the drawing rollers, the distance between them being, in the machines of the patentee, merely two and a half inches; the retaining rollers in these are preferred by him to be fluted, and to be made to revolve one turn only for every eight of the drawing rollers.

This close position of the sets of rollers, the patentee states, is permitted by the maceration of the flax, which allows the rollers to draw out the fibres in much shorter lengths than would be possible without this operation, by which means much finer thread can be made from the same materials, which arises, we suppose, from the fineness of the fibres thus drawn out, bearing a due proportion to their shortness.

The machines are represented in the drawings of this specification as being of the vertical sort, with the sets of rollers placed one above

the other, instead of being in a horizontal plane, as others are made, for the same purpose. This position gives them the advantage of requiring no revolving belts, or other apparatus, to convey the slivers from one set of rollers to the other, and will also enable them to take up less space in the factory.

The management of flax is only described by the patentee; but it is easy to conceive how other materials of a similar nature are to be prepared and spun from these directions; and also how the machines are to be set in motion by the power of any of the usual first movers, though no precise instructions are given for this purpose.

Patent granted to Sir ROBERT SEPPINGS, *Knight, Somerset-house, London, for an improved construction of such masts and bowsprits as are generally known by the name of made masts and bowsprits.* Dated January 19, 1826.

The object of the patentee is to make large masts with small balk, in more numerous pieces, by which their cost will be considerably less than when made, as usual, of large Riga fir, in fewer parts, of greater dimensions.

The head and the heel of each of the masts of this new construction are to be made of the same shape, in order that they may be turned upside down in case of accident.

Masts of this description are to be formed of several pieces of balk, connected together by trennels, coaks, bolts, and hoops. When the mast is to be more than 33 inches diameter, the size of the balk is to be found by dividing its diameter by 4. The core of this mast is to be made of four pieces of balk of these dimensions, joined together by trennels, $1\frac{1}{2}$ inch in diameter, passed through them diagonally, 18 inches apart. As balk of this sort cannot be got of the whole length of the mast, the different lengths are to be so arranged that no two joints may lie in the same transverse section. 2ndly, That they may be as nearly as possible at equal distances from each other; and 3dly, that they may be in those places over which the hoops are to pass; which hoops being five inches broad, each butt, where they meet, will be secured by half the breadth of the hoop, or $2\frac{1}{2}$ inches of iron banding. The ends of these pieces of balk are to be united by coaks, 3 inches in diameter, and 6 inches long; and they are also to have coaks of about the same dimensions placed between them laterally. About this core eight other lengths of pieces, of the same thickness, are to be placed, two at each side, close to the first pieces; and four more lengths of pieces, cut of an angular shape, so that their sections will be similar to the quadrant of a circle, are to be placed at the four vacant angles, making the number of pieces, altogether, 16, at the transverse section of the mast; which mast being then shaped and tapered at each end, so as to fit it for being placed with either end uppermost, as first mentioned, and having iron bolts driven from side to side, through all the pieces, at due distances from one end to

the other, is to be further strengthened by having the hoops before mentioned, 5 inches broad, and $\frac{3}{8}$ths of an inch thick, placed round it at intervals $1\frac{1}{2}$ foot apart from each other throughout. These hoops, for the thick part of the mast, are to be made each of two semi-hoops, with ends turned out, pierced, and tapped, for the admission of strong screws, by which they are to be drawn together tightly; but the hoops for the smaller and tapering parts, at the ends, are to be of the common kind, and when in their proper positions, are to be put on in the usual manner. It will easily be understood that the rule for arranging the ends of the pieces of balk for the core, will also apply to those of the surrounding outside pieces, and that they are to be coaked together, both endways and sideways, in a similar manner, and to have their ends placed in the line of the hoops as before mentioned. The patentee states that scarfs may be also used for connecting the ends of the pieces of balk, but that he does not recommend this method, thinking that by the coaks preferable.

The timber used for making these masts, is directed to be well dried and seasoned before the pieces are put together; the holes for the trennels, and for the coaks, and the trennels and coaks themselves, are also recommended to be well painted, or coated with coal tar, previous to this operation.

The directions for making masts of the same sort, under 33 inches diameter, are nearly word for word the same as those already stated, and are repeated throughout in the specification. We shall, however, only notice the difference between the two methods, to avoid the needless tediousness of the other mode of explanation. To calculate the size of the balk for these smaller masts, the diameter of each is to be divided by 3, which will give the measure of the side of each piece. The iron hoops for them are to be of the same breadth as for the others, but are only to be $\frac{1}{4}$th of an inch in thickness, and the pieces of balk are to be fastened together likewise in the same manner, with trennels, bolts and coaks; but an extraordinary direction is given for the dimensions of the coaks for joining the ends of the pieces of balk, which coaks for those smaller masts are ordered to be "3 *feet*" long, and 5 inches in diameter, which we suppose to be caused by some mistake, either of the patentee, or of the person who engrossed the specification.

FRENCH PATENTS.

Brevet d' Invention for fifteen years granted to MADAME CHAUVEAU, *of Montlouis, Widow, for a new manner of manufacturing rice from potatoes.* Dated August 1, 1805.

The potatoes after being taken out of the water, (in which they have been boiled, we suppose,) are left to drain for a night, after which they are taken in lumps, and forcibly passed through a brass colander or sieve, held above a tin plate or tray, having a border round it about an inch high. The substance of the potatoes pressed

through the colander, falls like snow, on the tin tray, and is permitted to fill it as high as the top of the border.

The trays filled in this manner are carried to an oven, which should be equally hot as for bread. When the substance is done enough will be known by its becoming detached from the trays; then it is to be drawn from the oven, and beaten a little in a large mortar; and when it is reduced to bits about the thickness of a macaroon, it is to be passed into a mill of the sort used in making snuff, where the pieces are divided unequally. The matter having undergone this sort of grinding, is passed through different sieves, to divide it into rice of three species of thickness, and into rice flour.

The idea of preparing potatoes in this manner, originated, we believe, with M. Pictet, of Geneva. In the Journal of the Lyceum of Arts of Paris, in 1796, M. Grenet, has given an account of a good process for obtaining granulated potatoes, copied from that of the professor mentioned, and has described a very convenient apparatus for the purpose; a print of which, with a translation of the account of the process, will be found in the third volume of our first series.

The process might be advantageous for preparing a useful and wholesome article for sea store, that would keep better than common potatoes, and not be liable to vegetate; but as for the notion of converting potatoes into rice, or into flour, or into any thing else extraneous to their nature, which has been so often proposed, we believe it to be entirely chimerical, and either to originate in self-deception, or in a culpable intention of adulterating rice with an article made to resemble it in some respects, but which possesses nothing of its delicacy and freedom from flavour, and contains much more mucilaginous matter, and much less of a farinaceous nature.

We think M. Grenet's process, in all respects better than that of Madame Chauveau, except as regards the baking; though it is most probable that a stove would dry the granulated potatoes better than any oven, and with much less risk of either burning or scorching them. [*Repertory of Patent Inventions.*

To JAMES BUTLER, *of the Commercial-road, in the parish of Lambeth, in the county of Surry, for his New Invented Method of making Coffins, for the effectual prevention of Bodies being removed therefrom after Interment.*

This invention appears to be not a new method of making coffins, but a peculiar mode of fastening on the lid after the body has been introduced into the coffin, which the specification states to be "a new method of so effectually securing a coffin, that when the lid is fixed down by an original screw, it cannot be withdrawn, or the body abstracted."

The interior of the coffin is to be lined or bound with plates or ribs of iron, and in the lower part of the coffin within, there are to be holes with screw threads tapped in them. The lid having been placed upon the coffin, long screws are introduced into counter sunk holes,

and passing through the lid, and through holes in the side ribs, down to the bottom of the coffin, enter into the tapped holes above mentioned, by which means the lid is secured to the bottom.

But the particular feature of the invention is the fastening screws, the heads of which are made with a screw thread, tapped, in place of the cut or slit usually made in the head of a screw. Instead, therefore, of applying an ordinary screw driver to wind the screws into the holes, a winch or lever is screwed into the thread in the head of the screw, and by that means the screw is driven down to its intended bearing, (that is, until the head is bedded in the counter sunk hole of the lid;) and when the lid has been thus made fast, the winch or lever being turned the contrary way, comes out of the head, and leaves the screw fast in the coffin.

The head of the screw having been case hardened, a cut or cross groove cannot be afterwards made in it, so as to allow of the screw being turned the contrary way, neither can any instrument be introduced to withdraw it, as the edge of the iron plate into which the head is imbedded, effectually prevents it from being taken hold of. Enrolled, October, 1825.

To WILLIAM HURST *and* JOHN WOOD, *both of Leeds, in the county of York, Manufacturers, for their invention of certain improvements in Cleaning, Milling, or Fulling Cloth.*

These improvements consist in employing steam in the operation of fulling or milling woollen cloths, instead of soap and water, as heretofore. The machinery is the same as the ordinary stock used for fulling, into which the cloth is to be put and beaten, and turned over as usual; but in place of the soap and water commonly employed for wetting the cloth, a pipe, leading from a steam boiler, is introduced into the back or side of the stock, and the steam is made to blow through a number of small holes, so as to insinuate itself among the cloth, which by that means becomes thoroughly wetted, and all dirt and greasy materials are effectually driven out of the cloth by the steam.

As in this process the presence of water is objectionable, a waste pipe is placed in the bottom of the stock, to carry off the condensed steam. By these means the steam enters into all the folds and meshes of the cloth, and completely supersedes the necessity of soap, which effects a very considerable saving in the process, and allows it to be conducted with greater ease than by the old method. Enrolled, September, 1825.

MECHANICAL JURISPRUDENCE, No. VIII.

BY PETER A. BROWNE, ESQ.

On the Law of Patents for New and Useful Inventions.

Letters patent, *Literce patentes*, are writings of the executive power, sealed with the seal of state, whereby persons have authority to do or enjoy *that*, which they otherwise could not.

They are so called, because they are *open*, addressed to *all*, with the seal affixed; and ready to be shown for confirmation of the authority thereby given.

Patents are a species of *Monopoly*.

A monopoly may be defined to be, "an allowance to any person or body politic, of the *exclusive* buying, selling, making or using any thing whatsoever;" whenever this allowance interferes with the general freedom of trade or occupation, by restraining the right of buying, selling, or using any thing.

The power to grant it, has been considered an *odious prerogative*. It is said, upon high authority, that restraints upon the trade of the community, in favour of particular favourites of the crown, are contrary to the fundamental principles of the common law of England; and it cannot be denied, that there are ancient precedents of prosecutions against persons who had set up such claims.

History, however, informs us, that in the reign of Queen Elizabeth, monopolies of every kind, were exercised to an enormous height: almost every branch of trade was carried on, under a royal grant, of exclusive privilege. But in the 44th year of her reign, the Court of King's Bench, gave them a death blow. The case was this. The Queen, by her letters patent, granted to one Ralph Bowes, the exclusive privilege of making, and importing, playing-cards. One T. Allein was sued for a breach of this patent right, and he, having admitted the making of part of the cards, pleaded his right to manufacture them, *according to the laws of the Kingdom*.

To this plea the plaintiff demurred; the cause was solemnly argued by the ablest counsel. The court delivered their opinion that the *exclusive* grant of the queen was *void*. They observed, that all trades were for the public good, for the exercise of youth in labour, and therefore that they could not be appropriated to *one solely*.

It was, most probably, owing to this decision, that King James the first, shortly after his accession to the throne, wrote a book, in which he stated, among other things, that monopolies were contrary to law, and he commanded, that no one should thereafter solicit him to grant any such privilege. This book was published in 1610, and 13 years afterwards, the parliament of England passed their famous Statute of Monopolies, reiterating the same sentiment.

Then, according to the common law of England, and this declaratory statute, (which having been passed before the settlement of the United States, was binding on our forefathers,) monopolies *derogatory to the common right of trade*, are illegal, and cannot be granted to, or exercised by any one in this country.

To this it may be proper to add, that even if the right to grant such monopolies had existed in England at the time of our colonization, being one of the royal prerogatives, it would have been abolished by our revolution; and cannot exist here, as it is inconsistent with our free constitutions, which are founded on the principle, that "the right to acquire, possess and protect property, is *general* and *indefeasible*."

To grant to *one* citizen, an *exclusive* right to use that which belongs *equally to all*, is unjust, and iniquitous; but it is not so, to *secure* to a man the exclusive privilege, for a limited time, to use the produc-

tions of *his own genius* or *reflection*. If a person is entitled to the products of his manual labour, why shall he be deprived of the avails of his *intellectual exertions*. They are both equally his own, and he may use them in secret, and destroy them when no longer wanted, without incurring any moral guilt. If he imparts them to another, cannot he stipulate for a consideration, and a covenant not to disclose the secret to his disadvantage? and if, instead of disclosing it to an *individual*, the inventor makes his contract with the *public*, may he not do it upon the same conditions? There is then nothing unjust, or iniquitous, in securing to the *author*, the exclusive privilege of using *his own invention* for a certain number of years, in consideration of its ever after becoming public property.

This contract is equally advantageous to the individual, and the state; to the individual, it secures, for a limited time, the products of his own exertions; and when, at the expiration of that period, the invention is cast into the common stock of property, to be freely used by all, the state is fully compensated for the protection she has granted. Nor is there any thing in this doctrine, which contravenes the principles of the common law; for by that law, the king had the power of conferring on the *inventor* of any useful art or manufacture, the exclusive use of it, for a reasonable time.*

General rules of construction of the Patent Laws.

It is next to impossible to lay down any *general rules* for the *construction* of the patent laws, which will be applicable to all cases; but under the *above* head, it is thought proper to introduce some rules that have been judicially recognized, and which do not strictly fall under any other.

1. It is said that in England, grants flowing from the royal bounty and grace, are generally construed most favourably for the king.

2. As, in the United States, the patent is a *constitutional right*, the above rule has no application here.

3. The patent, in England, usually contains a proviso, that it shall be construed most favourably for the patentee.

4. As there is no such proviso in the American patents, no such construction can be required.

5. It will also appear by a recurrence to the English cases, that their courts have, at different times, adopted arbitrary rules of construction, accordingly as they thought the patent laws, politic, or impolitic. Formerly, they confined the patent within very narrow limits, giving the specification only a *literal* meaning; on the other hand, Justice Buller, in Turner *v.* Winter, 1 T. R. 606, declared that he had always had a strong bias in favour of patentees: and Lord Kenyon in Hornblower *v.* Boulton, 8 T. R. 98, confessed that he was not one who favoured patents.

6. The rule which applies to the United States, is the one laid down by Lord Elden, when C. J. of the Common Pleas, in the case of Cartwright *v.* Armat, viz. that the patent is a *bargain* made between the patentee and the public; and that it must be construed upon the same principles of *good faith*, that regulated all other contracts.

* Godman on Patents, 44.—and the authorities there cited.

The rules of construction arising out of the different parts of this contract, will be noticed in their respective places.

We come now to speak of the *qualifications* of a *valid* patent. These are, 1st, The *personal* qualifications of the patentee. 2nd. The qualifications of the *invention* or *discovery*. The personal qualifications of the patentee, apply to him, as being a subject or a citizen, or as being an alien and resident.

As being a subject, &c.

The statute contains no restriction, confining the grants to British subjects, and foreigners are permitted to take out patents; nor is there any restriction in this respect, in the United States Constitution. But the act of Congress of the 21st February, 1793, limits it to our own citizens. The words are, "When any person or persons being a *citizen* or citizens of the United States, &c.

Mr. Fessenden in his essay on the law of patents, says, that patents can be legally obtained by none but those who are *native* citizens, their heirs or assigns. This is an error, the word citizen, in the act of Congress, includes all, whether *natives* or *naturalized*.

As to aliens and residents.

By the 1st section of the act of Congress, passed the 17th day of April, 1800, all the benefits of the former act, are extended to all aliens, who, at the time of petitioning, &c. shall have resided for two years within the United States.

The act declares, that the privileges shall be obtained, used, and enjoyed, by such persons, in as full and ample manner, and under the same conditions, limitations and restrictions, as by the said act is provided and directed in the case of citizens of the United States.

The section then contains a proviso limiting the enacting clause; it is in these words, "*Provided always*, that every person petitioning for a patent for any invention, art or discovery, pursuant to this act, shall make oath, or affirmation, before some person duly authorized to administer oaths, before such patent shall be granted, that such invention, art, or discovery hath not, to the best of his or her knowledge or belief, been known, or used, either in this, or any foreign country; and that every patent which shall be obtained pursuant to this act, for any invention, art or discovery, which it shall afterwards appear had been known or used previously to such application for a patent, shall be utterly void.

This proviso puts aliens on grounds somewhat different from those of a citizen, for while the law requires, in the case of a citizen, that the discovery should be unknown, and not used as the invention of any other than the patentee, before the application for the patent, this proviso, in the case of an alien, requires that it should not have been used, before the application for a patent, by *any one*, whether the *patentee* or another.

This important distinction is pointed out in the case of Huntington *v.* Morris, M. S. rep. c. c. U. S. for the Southern District of New York.

Judge Thompson says, "in reference to the objection drawn by the defendants' counsel from the first section of the act of 1800,

placing aliens on the same grounds in certain respects as citizens, I consider it not sound. This section first proceeds to extend the benefits of the patent law to aliens, equally as they are enjoyed by citizens, and under the same limitations; aliens must take the same oath as to being the inventors, &c. Then comes the proviso, requiring them to swear that the invention has not been known, or used, in this, or any foreign country. This proviso is a limitation on the enacting clause, according to the general rule of construction, and is to be construed as limiting and restraining the grant to which it is applied. It puts the alien on grounds somewhat different from those of a citizen, requiring an oath of something more than is required of a citizen, and this view strengthens the construction given above, to the first section of the act of 1793. Then the clause of the proviso goes on to state, that if it shall appear that the thing patented, had been known or used previous to the application for a patent, the patent should be void. It seems reasonable to restrict an alien in this manner, from taking out a patent for what had been in use abroad, inasmuch as our own citizens could not patent a foreign invention."

Two or more persons who are the *joint* inventors may take out a *joint* patent.

This was decided by Judge Story, in Barnet *v.* Hall, 1 Mason's reports, 472; he observes, "In the first place, a joint patent may well be granted upon a *joint* invention. There is no difficulty in supposing in point of fact, that a complicated invention may be the gradual result of the combined mental operations of two persons acting together, *pari passu* in the invention; and if this be true, then, as neither of them could justly claim to be the *sole* inventor, in such a case, it must follow, that the invention is *joint*, and that they are *jointly* entitled to a patent.

And so are the express words of the patent act, which declares, that if any person, or *persons*, shall allege that he or they have invented, &c. a patent shall be granted to him, or them, for the invention."

An Essay on the Bombyx Mori, or Silk Worm, read before the Maclurean Lyceum of Science of Philadelphia, June 11th, 1826, by John T. Sharpless, M. D.

(Continued from p. 29.)

As the cocoon is the valuable part of the labours of the silk worm, every means should be discovered, and practised, to ensure a good crop. The quality and quantity of the thread, depend on the diet, upon the care bestowed, the breed, &c. The white mulberry is, undoubtedly, the best food; they will, however, live, and even thrive, on other vegetables. In Calabria, the red is preferred, as it is thought to produce a stronger silk; and in Granada, the trees are all of the black kind. If a worm is furnished with a mixture of the three kinds, it will first eat the white, then the red, and lastly, the black. The Tartarian mulberry, ranks with the red in point of

goodness. It is also said they will live on the paper mulberry, dandelion, cowslip, blackberry, elm, &c.; but that they do not thrive when thus fed. It was before remarked, that lettuce was used, when the right food could not be obtained, but it is generally thought that they will not flourish, or spin good silk, when fed on this vegetable.

Miss Rhodes, of England, supposed this to arise from the coldness of the food, and on this intimation, General Mordant tried the experiment, of keeping the room and food quite warm, and completely succeeded in producing a good crop; he, however, made but one trial. If this should be confirmed, it would be better to cultivate the cabbage lettuce, as more economical than the mulberry, and as the internal leaves are always dry, even in rainy weather, we should not endanger the lives of the animals in a wet season.

A new mode of preparing the food of the worm, has been proposed by Dr. Bellardi, a botanist of Turin; which mode he considers original, but, according to Duhalde, the Chinese have followed it for a long time. His plan is to collect the mulberry leaves in the autumn, whilst in their prime, and dry them in the sun; they must be finely powdered, either in the winter or spring, and slightly moistened when used. On this the animal feeds greedily, and will even eat it after having enjoyed the fresh leaves.

The number of times they are fed has a great effect on the silk produced. The Chinese by frequent feeding, bring them to maturity in twenty-three days, instead of forty-three, whilst the quantity, and quality, of the silk are vastly improved. "A quantity of worms weighing but a drachm, on emerging from the egg, will produce twenty-five ounces of silk. If the maturity is delayed to twenty-eight days, but twenty ounces are raised, and if they are near forty days, but ten ounces." No experiments have yet been made in this city on this subject, but it probably holds equally true.

I have already made some observations on the care necessary to be bestowed on the worm, and have remarked that their ordure should be removed every day. This is, undoubtedly, the safest plan, though from some experiments of Dr. Anderson, it would seem that even this was unnecessary. He found that by strewing fresh slaked lime in powder, over the moveable drawer in the machine already described, all disagreeable scent was removed, and the gases which injure the animal, neutralized. Mr. Blancard proved that carbonate of lime would answer the same purpose; this he did by placing some worms in bottles, during the time between their different changes, and not removing any of their dirt or litter: in some of the bottles he sprinkled powdered chalk, and in others, none: those that had the chalk, produced full sized, first quality cocoons, whilst the others spun small, and very imperfect cods. The chalk, however thick it was spread over the worm, did not in the least incommode it. He also recommends that the walls of the rooms be occasionally whitewashed.

As the breed of the animal is of great consequence, we should be careful to procure eggs of the best kind. I have before remarked, that Spain generally produces the best quality insects; the northern

Italian worm, is also good, and Mr. Alexander possesses a Friuli worm that is probably equal to any Spain can yield. In the Hospital of this city there are two breeds, that differ somewhat in their shape and marks, the best of which came from Genoa; the other has been a good worm, but as they all will, when neglected, it has degenerated, now producing a small, long, yellow cocoon, and the quality of the silk is very inferior; whilst the other displays a large, round, white cod, vastly superior in quality. The Chinese writers, according to Duhalde, in giving directions for the preservation of a good breed, say you must expose your eggs at the same time, to precisely the same heat; they will then, if healthy, all hatch on the same day; and those, therefore, that come out, either before or after the mass, are kept separate from the rest, and are never preserved for seed. Of those cocoons that are preserved for eggs, the flies that appear before, or after, the second day, are discarded, as being unhealthy and unable to lay good eggs. Even of those that come under the above description of good flies, they still have their choice, throwing away those that have "bended wings, bald eye brows, a dry tail, and reddish, blue, or yellow, body."

I have not been able to ascertain, positively, whether the black or white worm is the best, though many prefer the black; neither do we know the cause of this difference in colour, whether produced by food, or culture, or whether it is a distinct variety of the animal; they will, however, intermix, and produce other shades of colour.

As at the end of five or six days, the animal has ceased his spinning, the cocoons that are to be reeled immediately, may now be used, but those that are to be kept for use at another time, must have their inhabitants destroyed, or they will make their way out. There are several colours of the cocoon, as white, fawn, yellow, greenish and orange; but I have never seen the fawn coloured, as the production of any but the Genoa or Friuli worm. They are divided into several classes or kinds, which are to be kept separate; colour being little regarded, though the white is considered rather the best, next the straw colour, and lastly the orange. The orange is thought to be the strongest silk, but the white, the finest. The cocoons from the mountains, are better than those of the plains, from the more healthy nature of the animal. There are also generally more white cocoons among them.

There are, first, the *Good* cocoon; these are strong and firm, nearly equally round at each end, not very large, and free from spots. There is, a second good cocoon, that is called the *Calcined*, where the animal has died and been reduced to powder, which may be known by the sound, when shaken, and bring, in Piedmont, one half more price than the others. The third, or *Choquette*, is also a good cocoon, producing fine silk, but the insect having died before it had finished spinning, it is apt to furze when wound. In these, the animal cannot be shaken from end to end, but sticks to the side. The fourth kind is the *Cocalon*, these are rather larger than the *Good*, but produce no more silk, the texture being loose and soft. The fifth is called *Dupion*, or double cod, because they contain two or

more larvæ, which have their threads interlaced so much, that they cannot easily be wound, and are, therefore, often kept for seed. The sixth is the *Soufflon*, where the texture is so loose, and transparent, that the worm can be seen; these cannot be wound. The seventh is the *Pointed*, where the ends, from their sharpness break off, and the thread is spoiled. The eighth is the *Perforated*, where the moth has made its way out. The ninth and last, the *Bad Choquette*, is spotted and rotten, and makes a black silk. The seed are called the *Royal* cocoons.

After the selection for spinning has been made, the animals must be destroyed; to effect which, several means have been pursued. The usual modes have been, to place them in the sun, for a few days, or in an oven, after the bread has been removed; the temperature is then at about 160° or 180°. The Rev. Mr. Swayne of England, who has tried many experiments on the subject, advises that they be dipped in water nearly boiling, for two or three minutes, which, he says, kills the animals effectually, without injuring the silk, as in baking. He is then careful to dry them well in the air. This, however, is disapproved by Miss Rhodes, who says that it will not injure the chrysalides; and mentions this process as a means of saving the silk from those placed away for seed, the animal changing into the Fly, as certainly, after, as before this operation. This agrees also with my own experience. The fumes of sulphur have also been used to destroy the animal, but in vain. The Chinese employ the steam of salt water; and the vapour of fresh water has been successfully used in England, and some parts of Italy. The Rev. Samuel Pullein of Georgia, who published his remarks in 1758, directs that they be placed in layers of four inches thick, on a wicker frame, made to fit over a vessel of boiling water. This is to be closely covered over, and the steam very soon destroys the animal. The cocoons should then be well dried in the sun or free air.

If, however, the usual mode of baking is followed, they should be placed in shallow baskets, in a considerable quantity, and put in the oven for an hour; they should then be examined, and one of the middle ones opened, to see if the animal is dead. Great care must be taken to keep them from burning. After this process, wrap the baskets up in a blanket, and if your baking has succeeded, it will be covered with a heavy dew; if this does not appear, they are too much burned, or are not dead, which must be decided by examination. You must leave them thus wrapped up for five or six hours, and those that were still alive will be suffocated. The baking in the oven is unquestionably the most certain mode of destroying the crysalis, as the sun sometimes merely renders them torpid. When the worms are dead, the cocoons must be placed in the air to dry, or they will mould and spoil.

The next operation is winding off the thread. The filament of the *Good* cocoon, winds off much the easiest, and requires water nearly boiling hot. The *Dupion* and *Choquette* require boiling some time, and are then easily wound. The *Coculon* demands water of a lower temperature than either of the others, and are the most difficult to wind.

If the water is not of a right temperature, the silk will be spoiled, for if too hot, the thread is dead and flimsy, and if too cool, the fibres do not join well, and make a harsh cord.

It has been a very general belief that the *Perforated*, could not be reeled, from the division of the fibres by the animal, but as was before remarked, Mr. Swayne denies the rupture of the threads, and asserts as incontrovertible evidence, that he has unwound several of these cocoons without much difficulty, and has not found a single end at the orifice. This winding must be done without water, or the thread becomes entangled instantly. The filaments thus unwound, although stained by what has been called the corroding liquor of the insect, he asserts was as strong and uninjured as from any other part. It is necessary that the water used in reeling be soft, as river, pond, or good rain water; spring, or well, or lime stone water, not dissolving the gum.

The floss silk is first removed from round the ball, and put away for carding. The balls are then thrown by handfulls into a copper placed upon a furnace to keep the water of a proper temperature. The cocoons are then stirred about with a stiff wisk, about six inches long, to this the ends of the thread will stick, and can then be raised. These ends should be cleaned between the fingers, from all the loose silk, and gum, which operation is called, by the French, *La Battue.*

When the threads are clean, pass four of them through a hole, of which there should be several, in an iron plate fixed across the vessel. As many of these collections of filaments are placed together as will produce the quality of thread desired. These ends are twisted together several times, and then attached to a reel. The fibres of the cocoon are connected together by a gum which surrounds them; this is softened, but not entirely dissolved in the water. To prevent, therefore, the different large threads sticking together on the reel, and producing a rough silk, the French winders are compelled to allow a space of thirty-eight inches between the copper and the axis of the reel, and also have attached to the machine, a traversing arm, carrying the threads backwards and forwards, covering a space of two or three inches, so that the fibres may not come in contact with those immediately preceding, but have time to dry. (See plate Rees' Cyclopedia, Art. Silk.) As the filaments break they must be renewed, and when the balls are half unwound, more must be added, as the silk becomes much finer as it passes toward the centre, one fresh thread being equal to two, half wound. This addition is made by attaching the new fibre to the mass, and giving it a twist. When all the good silk has been wound off, the inner case or husk, or, as the French say, *Biarré*, breaks up, and makes the thread foul and lumpy. These husks must be removed and opened, the insect within being good food for poultry, whilst the shell is placed among the other offal, to be carded.

The water from which you wind, must be changed frequently, as it becomes full of little filaments, and of the gum. The worm also discolours the fluid, and spoils the beauty of the thread. The *Dupions* or double balls, and *Choquettes*, are generally used for sewing

silk, and fifteen or twenty are placed together for that purpose. In winding you will meet what are called *Bassinots*, that are full of knots, these should be removed and thrown among the rough silk. The husks, and indeed all the waste silk, except the floss, is boiled with potash before being carded, and all, when spun, forms a strong coarse silk, called *floretta*.

Round each filament of silk, I have before remarked, there is a fine coat of gum, this forms nearly one-third of the thread, and is soluble in water, but not in alcohol; it is precipitated by many chemical agents; and when the water is evaporated, in which it is dissolved, a black, brittle varnish is obtained. There is also another substance resembling resin, which alcohol will dissolve, and the silk deprived of this becomes of a beautiful white colour.

The quantity of silk obtained from the cocoons must now be considered. The general length of the thread is from two to five hundred yards, and some are even said to be six miles in length. The experience of silk raisers has been very different as to the quantity of silk to be procured from a given weight, or number of cocoons. L'Abbé Sauvage says, that with good management, one ounce of seed, or forty thousand worms, will produce one hundred pounds of cocoons, but with ordinary care, only fifty pounds. Mr. Murray, a writer in the Trans. Soc. for the Encourag. of the Arts, states that in Varese, the product is from fifty to sixty pounds. But almost every writer differs as to the quantity of reeled silk derived from a given number of the balls. Mr. Chazal, of the Isle of France, produced one hundred and eighty French ounces from fifty-five thousand cods.

Mr. Salvator Bertezen,	by a mode that he has never divulged, obtained 5 lb. Troy, from 12,000 cocoons, which allows 2.04 grs. each ball.							
Mr. Swayne,	5 lb.	do.	do.	13,405	do.	do.	2.14 grs.	do.
Mrs. Williams,	5 lb.	do.	do.	14,640	do.	do.	1.96 grs.	do.
Mr. Pullein,	5 lb.	do.	do.	16,480	do.	do.	1.74 grs.	do.
Miss Rhodes,	5 lb.	do.	do.	21,000	do.	do.	1.37 grs.	do.

The late Dr. Morgan of this city, (*Philos. Trans.*) admits rather less than Mr. Pullein. Reamur, in his report on the feasibility of cultivating the spider, as a source of silk, calculates 3 grs. for each cocoon, but I presume he must have made some error in his weights. In a communication with which I was favoured, a few days since, by Mr. Fitch, of Mansfield, Con. whose answer to the committee of Congress on this subject was published in their report, he says that their ordinary success, is about 5 lb. from 15,000, which approaches, nearly, the estimation of Mrs. Williams. In the report of the Filature of Philadelphia, 1770, they say that one ounce of eggs, or 40,000, will produce 8 or 10 lbs. of silk.

I will now speak more particularly of the mulberry tree, and its cultivation, as a source of food for this important little being. It is called in Botanical language, *Morus*, and of it there are several species. The Alba, Rubra, Nigra, Tartarica, and Paperifera. Considering the Alba, or white, the kind best adapted to the nourishment of the animal, I shall confine my attention to its propagation. Though not a native of our country, it has become perfectly naturalized, and

grows in every variety of its soil and climate. Many plans have been proposed for its cultivation, but the most common is by the slip; it is sometimes raised by sowing the seed, in drills, or broad cast: the latter is mown and appears to be principally an American system, it is also said to be practised in India, but has not, from what I can understand, been very successful; the roots dying in a few years. Should it be thought proper to adopt this mode, the land must be good, and prepared as for grain. The seed is to be mixed with about an equal quantity of fine gravel, and sown early in the spring; it soon comes up, but is not gathered till the following spring, when it is about 3 feet high. It is sometimes allowed to remain 2 years, unless the land is very good, and the shoots grow with great rapidity.

The Chinese also sow it broad cast; but only for the purpose of selecting the best plants to remove into their nurseries. They mix an equal quantity of millet with it, which growing rapidly, shields the tender shoots from the sun. In the fall, when the millet becomes perfectly dry, it is set on fire, and burns off all the mulberry stocks, which shoot forth with great luxuriance, the following spring. To prepare the seed for any purpose, the fruit must be gathered when it is perfectly ripe, selecting berries that are not worm-eaten, or blighted: it is also of the first importance that they be gathered from good trees, as, according to the French and Chinese, there is a great difference in the quality of the tree itself. The leaves of a good tree are large, soft, smooth, rather light coloured, and little cut or indented. Duhamel thinks the seed should be gathered in countries where the cold is rather severe, the tree being by that means more hardy, and the leaves equally nourishing. The Rose leaved or Spanish mulberry is preferred, by Mr. Bourgeois, as a stock for propagation, for although any kind of white mulberry will produce leaves enough, they are not all alike in quality. When, therefore, we have chosen a tree for the fruit, it should be trimmed, and all the branches separated, allowing the sun and air to have free access to all parts, and should then be undisturbed till the fruit is gathered. The berries should be well mashed by the hand in water, and after standing in the pulp a short time, the water should be allowed to run off, and a fresh quantity added, and the process repeated, until the seeds remain clear. All the seeds that are light and float, must be thrown away; they should be large, heavy, and rather light coloured, producing much oil when pressed, and crackling when thrown on a hot iron.

(TO BE CONTINUED.)

ON JAPANNING AND VARNISHING.—No. 2.

By the Editor.

In treating upon this subject, the spirit varnishes will claim our first attention, as they are used for a greater number of purposes, than either of the other species.

It is intended in these papers to preserve, in general, a systematic

arrangement, but as it will sometimes happen that a recipe may present itself, or a process become known, after we have passed that point which it would have occupied in a perfect system, we shall not, on this account, refuse a place to any thing which is deemed useful.

On Alcohol.—The various kinds of spirituous liquors, derive their strength, their combustibility, and their intoxicating property, from the presence of one ingredient, which is common to them all, this ingredient is denominated *alcohol.* Proof spirit, whether known under the name of whiskey, gin, rum, or brandy, consists of about equal parts of alcohol, and of water; the peculiar flavour and odour of each being derived from the accidental presence of some portion of the article from which it has been distilled, and from which it may completely, although not easily, be separated by rectification. The liquid usually sold under the name of *spirits of wine*, is in general a highly rectified spirit, intermediate between proof spirit and alcohol; but not sufficiently concentrated for the purpose of making varnish. The name however will not serve as a guide, as the two are frequently used without discrimination, and the purchaser fails in his attempt to dissolve the resins, in sufficient quantity to make varnish, in consequence of the weakness of the liquid employed.

The goodness of the alcohol should first be ascertained, and if it contains any notable quantity of water, it must be rejected, or the water must be separated from it, which may be readily done by a method to be presently described. The most common way of testing the strength of the spirit, is to put a small quantity of gunpowder into a cup, and to pour a small portion of the spirit upon it, so as to moisten it; the spirit is then inflamed, and if when burnt out, it fires the powder, the spirit is accounted good; this however is a very imperfect test, as a weak spirit may fire the powder, if but a small portion is dropped on it, the quantity of water which it contains, not being sufficient to wet the powder throughout, whilst a stronger spirit, if applied in larger quantity, may leave a sufficient portion of water to prevent the combustion.

The readiest practical method of determining whether alcohol will answer the purpose, is to fill a large vial with it, and then to drop into it a small lump of potash, or pearlash, which has been heated very hot over the fire, to expel its moisture, and which has not afterwards been suffered to become cold; the vial is then to be well shaken, and if the lump remains dry, or nearly so, the alcohol is good, but if any considerable portion of it is dissolved, it is unfit for use.

Should the alcohol not prove good, it may be rectified, by putting into the bottle in which it is contained, a considerable portion of potash, prepared, and warm as before directed; if there is much water present, the potash ought to be equal in weight to one-third of the alcohol; on shaking the bottle, the water will dissolve the potash, and this solution will fall to the bottom of the vessel, forming two distinct liquids, as separate from each other as oil and water; after this has stood for some time, the alcohol must be carefully poured off, and the same operation may be repeated. The watery solution, and the lumps

of potash, may be put into an iron pot, and again desiccated, when it will answer the same purpose, as well as at first.

The above process, will leave the alcohol of a reddish colour, of which it may be deprived by distillation; but this colour is of no consequence whatever in the making of ordinary varnishes, as it will not give a sensible tinge, excepting to the lightest kinds. When it is desired to deprive the alcohol of this colour, and the means of distilling it are not at hand, it may be accomplished by putting into the spirit a small portion of calcined (or burnt) alum, the acid of which will combine with the potash, which will then fall to the bottom. Should the alcohol still retain any colouring matter, it may be rendered perfectly colourless, by filtration through fresh burnt, pulverized charcoal. The method of doing this, and also a simple apparatus, by which any one may accomplish its distillation, will hereafter be described, for the sake of those who live at a distance from large towns, and are unable to purchase it in a state of purity.

There is another mode of trying the strength of alcohol, and that is by its *specific gravity*, or the weight of a certain bulk of it, compared with the same bulk of water; the greater its purity, the less it weighs, and when perfectly pure, its weight is but little more than four-fifths of that of water; suppose therefore you have a vial, which, when filled to a mark made on its neck, holds exactly five ounces of water, the same vial, filled with alcohol, to the same mark, ought to contain but a small fraction more than four ounces. The philosopher may require greater precision, but for the practical man the foregoing method is sufficiently correct, and may readily be employed. It is evident that the size of the bottle is unimportant, provided the weight of the alcohol, which it will contain, is but little above four-fifths of the weight of its contents of water.

On Lac, or Lacca.—Lac is a resinous substance, imported from the East Indies, where it is found on several species of trees; being deposited on the twigs by an insect, the *coccus lacca*. Lac is brought to us in three states, known under the denominations of stick-lac, seed-lac, and shell-lac. The former consists of the resin attached to the twigs, the seed-lac is the same substance separated from the wood, the shell-lac is in the form of thin lamina, or plates. Lac in its native state, contains a considerable quantity of colouring matter, of which it is nearly deprived, before it is exported, as it is employed in India, for giving a beautiful red, and some other tints, to cotton, and other goods.

In the application of Lac to the purpose of varnishing, we shall confine our observations to seed-lac, and shell-lac; and as the latter is the kind most extensively employed, we shall consider it first. The books inform us that shell-lac consists of the seed-lac purified, fused, and run into thin plates. There is however, sufficient reason to doubt the correctness of this statement, as the shell-lac, is much cheaper than the seed-lac, is more fusible, much more easily dissolved in alcohol and forms a softer varnish; it is highly probable therefore, that shell-lac contains a considerable portion of some cheaper resin, with which the lac is fused, at the time of its formation.

Shell-lac varnish.—In making spirit varnishes, it will be found that the resin to be dissolved, may be from one-third, to one-fourth of the weight of the alcohol employed; a complete solution of a larger quantity cannot be effected; and some of the resins used are much less soluble than this. The best shell-lac, is that which is most transparent, and which has the greatest brilliancy of surface. Its hardness is also a good test; of two portions, that which is least easily scratched with the point of a knife, may be considered as the best. To every pint of alcohol, from three to four ounces of shell-lac may be added; glass bottles are generally employed for containing the mixture, but vessels made of tin are much to be preferred, for very obvious reasons. The shell-lac ought not to be pulverized, but may be put into the spirits, in pieces as large as the vessel will admit. In warm weather it is not necessary to place it near a fire, as it will, if frequently shaken, dissolve in the course of a day. Frequent shaking is of importance in making this, and many other varnishes, as the resin will otherwise agglutinate into one mass, and will be afterwards dissolved with difficulty. In cold weather the bottle may be placed near a fire, so as to keep it slightly warm; if much heated, there will be a considerable loss of alcohol, by evaporation; there should be a small notch cut the whole length of the cork, to allow the escape of vapour, when placed near the fire, otherwise the cork may be blown out, and if too close to the fire, combustion may be produced. Those who make spirit varnish in the large way, use a barrel churn, into which the materials are put, and they are agitated until the whole of the resin is dissolved. This is an excellent mode, as there is no loss from evaporation, and the resin is prevented from agglutinating. Shell-lac varnish is never perfectly clear, as the resin contains some matters not soluble in alcohol; when the lac is dissolved without heat, the greater part of this remains at the bottom, but if made pretty warm, it is diffused in clouds through the whole mass, nor can it be separated by filtration; this, however, does not interfere with the goodness of the varnish, and may, probably, add to its toughness. Should the solution prove too thick, more alcohol may be added; this is best done in small quantities, as the varnish is used. Where hardness is not a point of importance, a small lump of common rosin is added to the shell-lac, as this substance increases the brilliancy of most of the varnishes; it ought, however, to be used with a sparing hand, as it renders every species brittle.

Shell-lac is of a yellowish brown colour, and will not, therefore, answer for those articles which would be injured by this tint; it is otherwise the best of the common spirit varnishes, whilst it at the same time, is the cheapest. It answers well upon mahogany, and upon most coloured articles; but when used upon those which are black, it must be made of that colour, in a way to be hereafter described, or it will give an evident shade of brown.

Professor Hare, has discovered a mode of depriving shell-lac of its colouring matter; the process has been made known to the editor, but he does not conceive himself at liberty to publish it at present;

but a communication upon the subject is expected shortly, and will appear in this Journal.

When wood, or other porous materials, are to be varnished, they ought to be coated with some substance which will cause it to *bear out;* the pores may thus be completely filled, and much time, and varnish, saved. For mahogany, and some other woods, boiled linseed oil may be used, particularly if it is desirable to heighten the colour. Thin size, made from common glue, that from isinglass, the glare of eggs, gum-water, or gum tragacanth, are occasionally employed; the object in view, being to prevent the absorption of the varnish by a coating of some substance not soluble in alcohol. When linseed oil is used, it ought to be rubbed on sparingly, then wiped carefully off, and a day or two should be allowed for it to harden, before the varnish is put on.

For ordinary work, the varnishing brush may be a *sash-tool* of a suitable size, as the varnish, if not too thick, will flow and spread itself evenly, although the hairs of the brush may not be fine. When the varnish is used thin, and the articles to be varnished are of the finer kind, or the surface great, the flat, camel's hair brushes, are to be preferred. In general, three or four coats will be found necessary, and when wood is very porous, or the varnish is to be rubbed down, and polished, double the number may be required. In dry weather, the spirit evaporates so rapidly, that the coats may follow each other, at an interval of a few minutes only; but great care should be taken that the last be perfectly dry, before another is laid on. It frequently happens, that the varnish assumes an opaque white appearance, as it is laid on, losing all its brilliancy. This is occasioned by the moisture in the atmosphere, and indicates that a close room, and a fire, are necessary; and without these it will be useless to persevere. The transparency will, however, be restored by the next coat of varnish, if laid on in a place that is warm and dry. This frequently occurs, when, judging by appearance, we should think the day most suitable for varnishing.

It will be perceived, that many of the preceding remarks apply to spirit varnishes, in general, as they all possess certain properties in common, and require, therefore, a similar mode of treatment. The mode of polishing, and some other particulars, which will be treated in the next number, will partake of the same character, and will not need to be repeated, when other varnishes are considered.

A description of the American Slide rest, as made by Messrs. Mason & Tyler, of Philadelphia; with the improvements of other machinists.

[WITH A PLATE.]

Where perfect accuracy is required, in turning cylinders, cones, or flat surfaces, the slide rest, is an appendage to a lathe, which is almost indispensable. Those made by Maudslay, and by Holtzapffel and Dyerlein, in London, are justly esteemed, both for their beauty,

and the accuracy of their workmanship: and it is no small praise to aver that those made in this city by Messrs. Mason & Tyler, are equal in both respects, and reflect the highest credit upon those artists. The slide rest is applicable to other purposes than those above mentioned, particularly to the cutting of accurate screws, on work in the lathe. This application will hereafter be described.

A, fig. 1. (see plate) represents a piece of metal grooved underneath, to receive the holdfast, as in the common rest, having a circular projection at B, made flat at the top, forming a bed on which the circular base C rests, and is held fast to it by the screw-bolt D, in the centre of the base.

E, the main-bar connected to the base C by the supports F F, made perfectly flat on its upper surface, having the edges parallel and bevelled under, to fit the dove-tail groove, in the lower side of the main slide G; in the top of the main slide is the dove-tail groove, crossing the lower groove at right angles, which receives the cross slide I, on which the cutting tool is placed, and may be held by either of the screws, K.

The screw H, which moves the main slide is supported underneath the edge of the main bar by a collar, P, at each end, to protect it from chips, &c. and works in a semicircular nut, T, which is attached to the main slide. The collars P P being smaller than the screw, permit the nut to pass over them, and the slide to be taken off at pleasure; L, a screw by which the cross slide is moved; it passes through the collar M, on the end of the slide I, and works in a nut formed in the bottom of the groove. At each end of the collar piece M, is a stop screw S, used in turning grooves of uniform depth, &c.

From the foregoing description, it is obvious that the cutting tool may be moved in the direction of either slide, or in lines at right angles to each other.

For turning cones, cylinders, concave surfaces, facing wheels, &c. the rest may be turned around the centre pin D, by which it is screwed down to the bed.

It is believed that this improved rest combines all the advantages of other instruments of the kind, with greater strength and firmness; and it is adapted to the common lathe.

A description of an improved lever press, for cutting, piercing, &c.
By RUFUS TYLER, *Machinist, of Philadelphia.*

(WITH A PLATE.)

The screw press is usually employed for the purpose of piercing and cutting metallic plates, for various purposes; it is, however, more difficult to construct, and, consequently, more expensive than the lever press, whilst the latter possesses the advantage of leaving both hands at liberty, to manage the work. For the purposes to which it is applied, it is in all respects equal to the screw press, and in several, superior; the practical workman will at once perceive the excellence of the mode of fixing the bed. This was formerly regulated by screws,

it was attended with great difficulty, and was rarely done with that accuracy, which is attained by the mode here described, with such facility as to render a trial unnecessary.

A, fig. 2, the body of the press, B, a cylindrical slide, working in the box C, which is connected to the lever D by the plates E E, a piece of steel, F, is introduced between the top of the slide and the lever, as seen in fig. 3; the use of which is to present sufficient surface to sustain the pressure, and to preserve as nearly as possible the uniform distance of the centres, which connect them.

G is a punch or cutter, the conical shank of which is accurately fitted to a corresponding hole in the bottom of the slide.

The die seat I, is a circular block of metal, expanding into a flanch at the bottom, by which the hooks K K hold it firmly down upon the flat bed upon which it rests.

By this arrangement the most intricate and delicate dies or cutters may be set with great facility, and the utmost accuracy, by any inexperienced person.

L is a stop screw, to prevent the cutter from entering too deep into the lower die.

The power is applied by the foot at the treadle M, which has a counter balance at N.

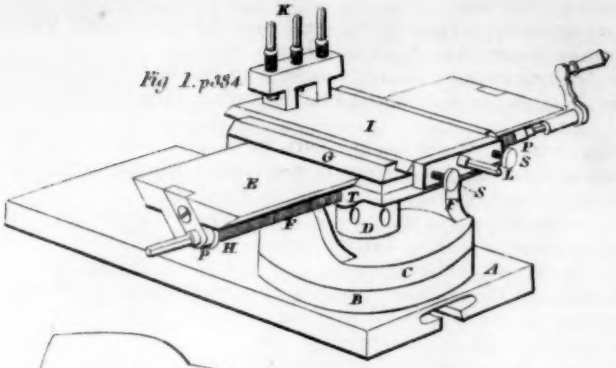
Bank Note Engraving.

[WITH A PLATE.]

The specimen plate which accompanies this number of the Journal, is from the office of Fairman, Draper, Underwood & Co. of this city; the kind of work which it exhibits, has long been successfully used, for the purpose of preventing counterfeiting. The whole, excepting the words, is performed in the lathe, and is therefore purely mechanical. The instrument by which it is accomplished, is denominated the *Geometric Lathe*, which was invented by Mr. Asa Spencer of Connecticut, but now of this city. An opinion, altogether erroneous, has been prevalent, that it was the product of the genius of Mr. Jacob Perkins; an intelligent gentleman in Connecticut, first suggested to Mr. Perkins its application to Bank notes, as a security against counterfeiting, and he in consequence, engaged Mr. Spencer to carry this suggestion into operation. Mr. Spencer accompanied Mr. Perkins to this city in the year 1816, when the lathe-work was first applied to the notes of the bank of the United States, by Messrs. Murray, Draper, Fairman & Co. When Messrs. Perkins & Fairman went to London in the year 1819, Mr. Spencer was induced to join them. The work was there put to the severest test, which the combined talent of that great metropolis could invent, and after having passed this trial in the most satisfactory manner, it was very generally adopted, and continues to be used by the banks and bankers of the United Kingdom.

The Geometric Lathe differs very materially from every other turning engine, hitherto invented. The only one, the work of which has

Fig 1. p.384



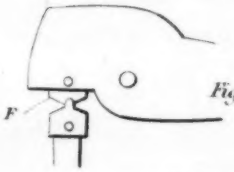
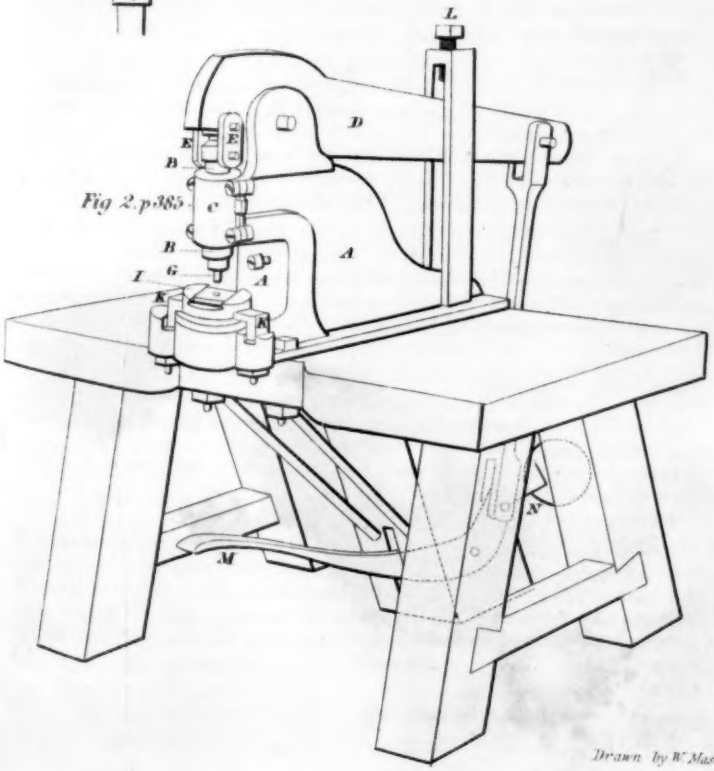


Fig 3.

Fig 2. p.385



Drawn by W. Mason.

any apparent similarity, is the Rose engine, by which the beautiful ornamental work on the metallic dial plates, and cases of French and other watches, is performed. This instrument is only capable of *copying* patterns, previously formed upon "*guides*," whilst the Geometric lathe, forms its own patterns, which are all *original*, and are as various, and as unlimited in number, as those produced by the kaleidescope.

In the rose engine, the pattern is produced by a great number of distinct lines, separate from each other, whilst the figures formed by the Geometric lathe, result from one continued line, which returns into itself. When a die is to be formed, or an article to be ornamented, the tool (a single point) is at rest during the operation, whilst the lathe is made to revolve, and carries the article to be turned, in all the various circumvolutions, requisite to form the complete figure. Those who are acquainted with Suardi's Geometric pen, can form some idea how this may be accomplished. We have compared the lathe, in the multifarious patterns which it is capable of producing, to the kaleidescope, the justness of this comparison will be obvious from the fact, that the inventor of the lathe, is unable to re-produce a particular pattern, excepting he has kept an exact register of the arrangement by which it was originally produced; and that under any new arrangement, the resulting pattern is known from trial only.

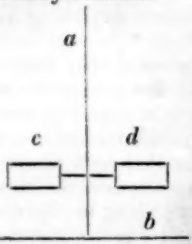
On carefully inspecting the specimen, it will be seen that on some of the figures, the lines are white, and the ground black, whilst on others, the reverse is the case: this is attained by what is called *transferring*; which bears some resemblance to the taking of an impression from a seal. When a steel die is made, the lines are cut in, like an engraving upon copper; this die is then hardened, and it is forced upon another piece of steel, with a power sufficient to produce a complete impression, so as to make a reversed die. By this means the effects produced, combine those of wood, and of copper-plate engraving, whilst the whole may be said to be mathematically correct, and defies the effort of the most skilful hand, to produce any thing like an exact imitation.

It has been said that what has been done by man, man may do again; to a certain extent this is true, but it is not absolutely so; who can reproduce a complicated form, which was the result of accident? the work of which we are now speaking, defies imitation as truly as that which is purely accidental. It is true that patterns may be produced which shall deceive unskilful observers; but this difficulty exists in the very nature of things; it is one thing to make an article which cannot be imitated, and another to create the power of discrimination, where nature has denied it, or where it has not been formed by habits of observation. We think that all that can be accomplished, in the prevention of counterfeiting, is to produce work requiring consummate skill, and expensive apparatus, so that a tolerable imitation, shall be equally difficult and unprofitable, whilst, to the discriminating, it may be absolutely inimitable. Is not this the case with the plan pursued by Messrs. Fairman, Draper, Underwood & Co? We think that this question may be answered in the affirmative.

We have mentioned the subject of transferring, as applied to the lathe-work, but to this it is by no means confined. Every kind of engraving, but more particularly the vignettes, may be transferred by means of steel dies made in the form of rollers. The engravings are at first made upon cast-steel, which is afterwards hardened, an impression, in relief, is then taken upon cast-steel rollers, which are also hardened; from these the whole may be transferred to plates of copper, or of steel, so that impressions precisely similar, in every dot and line, may be made upon any number of plates, and these impressions, when worn, may be renewed by the same tool, with a precision which is otherwise unattainable. A degree of labour, may consequently be given to a single figure, which could not otherwise be afforded, and the first talents may be employed, at almost any price. The copper-plates, like the impressions upon paper, may be said to be printed.

An account of an improved method of cooling wort, in the operation of brewing.

One of the greatest improvements lately made in the process of brewing, consists in the introduction of Fanners, for the purpose of cooling the worts. The machinery alluded to, has been in use for many years in London, where it has nearly superseded the troublesome and expensive method of employing currents of water conveyed by pipes. It was, we believe, first introduced into Scotland about three years ago by Messrs. Berwicks, very skilful and extensive brewers in this city. From the patterns in their works, the machinery has been copied by other brewers, and is, we understand, getting into general use here; but as it is yet little known in many parts of Scotland, a short account of it may not be useless to our country readers.



The *Fanners*, or *Fans*, as they are familiarly called, are of the simplest construction. *a* is an upright iron axis, to which four plate iron leaves are attached at right angles, to the shaft, and to each other; two of these leaves, *c d*, are shown in the figure. The distance from the outer extremity of the leaf *c* to that of *d*, or the diameter of the circle which the *Fans* describe, is about six feet. The leaf, which is about 8 or 10 inches broad at the extremity, and a little narrower towards the axis, presents nearly a vertical plane, but is slightly twisted. The axis works in a socket resting on the floor of the cooler *b*, and is driven by means of a pinion at *a*, communicating with a steam engine or horse machine. The worts generally stand 4 or 5 inches deep in the cooler, and the under edge of the leaves is about an inch, or rather more, above them. The Fans, when in operation, perform 120 revolutions in the minute, and create a very powerful current of air, which sweeps like a tempest over the surface of the liquid.

Every brewer knows the importance of rapid cooling. The worts are let down into the cooler at the boiling temperature, and the stronger they are—and of course the more valuable—the more difficult is the process of refrigeration. How the atmosphere acts upon them chemists have not very well explained; probably it is through the agency of electricity. But it is well known, that the longer the worts stand exposed to the atmosphere, the more they become what brewers call *vapid*; that is to say, they lose more and more of their flavour, taste, and fermenting power; and in certain states of the atmosphere, within less than the compass of a natural day, they are rendered absolutely useless. Now a single fan of the dimensions we have described, placed in the centre of a cooler 25 feet square, will cool 30 barrels, or above 1000 imperial gallons of worts down to the required temperature (50 or 60) in *two hours*. But to cool the same quantity in the old way, by the natural action of the atmosphere, would have required, on an average, *ten hours*; and during this period the worts, which can now be drawn from the cooler with their strength and flavour not sensibly impaired, would have been deteriorated to the amount of some per cents. Hence the brewers hold that worts cannot be cooled too fast; and that every hour's delay beyond what is absolutely necessary, injures the quality, and lessens the value. We may judge, too, from this fact, of the importance of the fans. Indeed, we know that skilful brewers consider their introduction as the greatest improvement which the art of brewing has received for a long course of years.

Worts are cooled in consequence of the evaporation which takes place from their surface; and hence the advantage of spreading them out in a thin stratum. The passing of a current of air over the surface greatly increases the evaporation, and of course reduces the temperature with a corresponding rapidity. As brewers knew this long ago, it is singular that the simple process now employed to produce artificial refrigeration was not earlier adopted. It is not found that either in the quick or the slow evaporation, there is any loss of materials, for the air carries off water merely, and leaves the vegetable extract (as it leaves the salt of the ocean) without any sensible diminution, and in that state of inspissation to which the brewer desires to bring it. There is another fact connected with the process in which the results of practice, are found to correspond with the deductions of theory. We know that air absorbs moisture in proportion to its dryness, and that when previously saturated with humidity, its power to absorb, and of course its power to produce refrigeration, ceases. Hence brewers find, in opposition to vulgar ideas, that, however hot the weather be, provided it is clear, they are able, with the aid of the fans, to cool their worts with facility, but in very moist weather, though chill, the fans are found to be almost useless, and the process of refrigeration in any way, is extremely difficult.

Among other recent improvements in brewing, the use of iron coolers deserves to be noticed as one of great importance. They are more easily kept clean than the old ones of wood; they are better conductors, and assist more in effecting a rapid reduction of tempera-

ture in the liquid; but what is of still greater consequence, they do not, like those of wood, afford a lodgment in their pores, to acid matter which taints or injures the worts. [*Edinburgh Scotsman.*

On the Material used in Tuscany, for Plat. By Mr. WILLIAM SALISBURY.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

It appears that specimens of the straw, with seeds of the plant, were, in 1819, brought to this country by Captain Roper, R. N. and were presented by him to H. R. H. the Duke of Sussex, President of the Society. Some of these seeds his Royal Highness gave to Mr. Salisbury, who sowed and obtained a crop from them in the following year. The plants being allowed to come to maturity, proved to be the *triticum turgidum*, a variety of bearded wheat, which seems to differ in no respect from the spring wheat grown in the vale of Evesham, and in other parts of England.

In the autumn of 1823, M. Fournier, of Geneva, a friend of Mr. Salisbury, being about to make a journey to Florence, was requested to make enquiries for him respecting the culture and subsequent preparation of the bearded wheat, as far as regards its application to the purposes of platting.

M. Fournier states that the bearded wheat is cultivated largely in Tuscany, both for food as well as for platting; and that he saw the plant grown for its straw alone, in various parts of the Val d'Arno, between Pisa and Florence. The seed is thickly sown on a poor stony soil, on the bank of the river: when the crop is some inches high, it is mown, but not very close to the ground; this treatment subdues, more or less, the rankness of the plant, and the stems that shoot up are slenderer than before. If they are still too coarse, the crop is again mown, and so on to a third and even a fourth time, according to the vigour of the plant. When the stems are sufficiently fine, they are allowed to grow; after the bloom is over, but while the grain is still very milky, the plants are pulled up and exposed to the sun on the sand of the river, care being taken to water them from time to time. When the straw is come to a proper colour, a very careful selection is made of it, according to its quality, and it is divided into several sorts, according to the size of the straw. The only part used is from the base of the ear a few inches down towards the first joint. The part between the first and third joints is reserved for common plat.

Specimens of the straw in its unprepared and prepared states, collected by M. Fournier, and given by him to Mr. Salisbury, were laid before the committee.

On Ancient Vases.

(From the Latin of Professor Hausmann*.)

The ancient painted vases, chiefly dug up in many districts of Lower Italy, have excited much interest among the learned, and the admirers of ancient art. While the elegance and diversity of their forms, together with the singularity and boldness of their figures, delight the eye of the beholder, the variety of design and subject in the paintings with which they are decorated, equally conduce to the illustration of mythology, history, and ancient art. The investigation of these paintings has already contributed in no small degree to improve our knowledge of antiquity; nor has the imitation of the forms of those vases been less a source of profit as applied to the art of pottery. The famous Wedgwood-ware owes its celebrity as much to the successful imitation of the forms of those vases as to the excellence of its material. In like manner, the beautiful ornaments observed upon these vases, have, in our times, been transferred to the subjects of many other arts; and have been employed for the decoration of buildings, rooms, furniture, articles of dress, and other works of luxury; insomuch, that antique forms have become so common in modern art, that their origin has been nearly forgotten. Although ancient art has, in this manner, made its way into the shops of potters, and other artificers, and even into our drawing-rooms, yet the scientific study of technology, and the history of the mechanical and chemical arts, have hitherto been little advanced by the investigation of those ancient vases. In the writings of the ancients we scarcely find any passages in which positive mention is made of them; and none, in so far as I know, where their composition is spoken of. This point, therefore, can only be ascertained by an accurate examination of the vases themselves. During a journey which I made last year through Italy, I had opportunities of examining the splendid collections of those vases, which adorn the museums of Florence, Rome, and Naples. The pleasure derived from this investigation was much augmented by some observations which it suggested to me regarding their composition. The little that I have learned with regard to this subject, either during my journey, or from subsequent observations and experiments, I shall endeavour to expose in the following essay.

Sect. I.—*Of the Vases commonly called Etruscan.*

We shall confine ourselves to the vases commonly called Etruscan, although the greater part of them are not of Etruscan, but of Grecian origin. The celebrated Winkelmann was the first who refuted the opinion chiefly supported by Gorius and Buonarotti, that these painted vases of pottery-ware had been manufactured in ancient Etruria. But although it cannot be denied that the greatest quantity of vases has been dug up in those parts of Italy and Sicily which were formerly inhabited by the Greeks, nor that the style of their paintings, and their inscriptions, sufficiently demonstrate their Grecian origin, yet it is

* Transactions of the Royal Society of Gottingen.

probable, that the art of fabricating painted vessels of earthenware, was not confined to that portion of Italy, but also extended to other districts, since, in many places remote from it, vases of the same general description have been dug up, which, however, possess so much diversity of character, with regard to their forms and paintings, as to induce the inference, that they had not been transmitted to those parts by commerce. Nor was this art confined to ancient Italy alone, but was also practised in Greece, and thence made its way into some of the neighbouring districts of Pontus. The painted vases found in these countries are essentially the same as those discovered in Italy.

The vases found in different parts and situations of Italy differ more or less from each other, both with respect to the quality of the material, and to the workmanship and style of painting; the cause of which difference is to be sought for in the different natural qualities of the materials, or in a different degree of perfection in the art. For the art of forming vases of pottery-ware, and of ornamenting them with paintings, may not only have existed in various degrees of perfection in different places at the same time, but the state of this art had also, without doubt, been very different at different periods. And not only have earthen vases of very different degrees of fineness been manufactured at the same time and in the same places, but also plain vases, without any paintings, in all other essential respects agreeing with the painted ones, and destined for the same general purposes.

Of the painted earthen vases, dug up in different parts of Italy, those found in Lower Italy and Sicily are the finest. The best of all, however, are those found at Nola, both in respect to the excellence of their materials, and the elegance of their forms, together with the beauty of the paintings and the lustre of their varnish-like coating. Many of them are so perfectly preserved, that you might imagine them newly made. Next to the Nola vases, are those of Locria and Agrigentum. Many vases have also been found near Pæstum, the ancient Capua (now S. Maria di Capua,) Sancta Agatha Sothorum, Trebbia, Aversa, Avella, Tarentum, and in some other places of Apulia, and of the Neapolitan province named Abruzzo, the greater number of which are remarkable for their beauty. Of late years, vases have also been dug up in the vicinity of the cities of Angi, and Pomarico, in Calabria. The largest and best collection of vases, found in these and other places of Lower Italy and Sicily, arranged most elegantly and in the best order, is preserved in the Royal Museum of Naples; this collection has, of late, been much enlarged by the purchase of the extensive one made at Nola, belonging to the family of Vizenzio. Of the private collections at Naples, the most remarkable is that of the Archbishop of Tarentum, which is preserved at his seat near Portici, elegantly adorned with the choicest works of ancient and modern art; and what renders this collection still more deserving of attention is, that it is illustrated by a learned description drawn up by its accomplished proprietor himself. A great number of vases, dug up in Lower Italy, have also been deposited in the Vatican Library at Rome, and the public Museum of Florence.

In the middle part of Italy painted vases have been found much

more rarely. In some places of ancient Etruria, as for example, near Volterna and the cities of Chiusi, Viterbo, and Corneto, a few were formerly dug up, some of which are preserved in the Florentine Museum. The true Etruscan vases may be distinguished from others by the inferior quality of their materials, by the dullness of their coating, but especially by the greater rudeness of their forms and painting, as well as by certain characters of the representations peculiar to the ancient Etruscan art. These differences may be very clearly seen in the Florentine Collection, where authentic Etruscan vases are placed in the same apartment with others of Grecian origin. In the great collection at Naples, I was shown only a single, mutilated, true Etruscan vase.

No vestiges of ancient painted vases have, in so far as I know, been found in Italy, to the north of the Appenines. Those which are preserved in the Museums of Bononia, Turin, and other cities of northern Italy, have migrated into those parts from southern Italy.

It is not my design in this treatise, to institute any inquiry into the periods at which these vases were manufactured, not only because investigations have already been made with respect to this point by many authors of great learning, but especially also because the settlement of it would involve an examination, entirely foreign to my views, of the various inscriptions observed on those vases, as well as of the subjects and characters of the paintings. It is undoubtedly more easy to discover the period up to which these vases may have been fabricated, than the time at which the art, commonly considered as of Grecian invention, but assuredly possessed of claims to a much higher antiquity, took its origin. It seems not improbable, that the latest period at which these vessels were manufactured in Italy, was the time of the civil wars. The Roman vases of later periods, dug up in many parts of Italy, as at Nola, Pompeii, and Rome, have a very different character. They have no paintings, but are frequently ornamented with raised figures, and usually have a red coating; characters which are also observed in the Roman vases dug up in some parts of Germany and France.

To a later period also belong the vases dug up in great quantity near Aretium, so far down as the time of Vasarius, many of which are preserved in the Florentine Museum. These vases have a red or blackish coating, and, in other respects, are of similar composition with the older Etruscan vases, with which they are sometimes confounded. It seems not improbable, that they belong to the Aretine vases, so highly esteemed in ancient times, which have been praised by Martial, and taken notice of by Pliny and Isidorus, although it is difficult to arrive at any certainty with regard to this point.

The painted earthen vessels of Grecian origin, which have been found in Lower Italy, seem to be of different ages. According to the opinion of the celebrated Millingen and some other antiquarians, an opinion which seems to be well grounded, the vases commonly, but incorrectly, called Egyptian, whose paintings are of a dusky red colour upon a yellow ground, in which condition some vases have also been dug up in Greece, are the most ancient. The vases, common-

ly called Sicilian, which have black paintings upon a reddish yellow ground, are, according to the same opinion, less ancient, but more so than the vases with reddish yellow figures and ornaments upon a black ground, which are the most common of all. This opinion has indeed been lately opposed by the celebrated Rossi, who has shown the vases with black figures, to be of the same age with the rest: his arguments, however, do not seem to invalidate the former opinion.

Many vases, either having no paintings at all, or, instead of figures, having other singular ornaments, have been dug up, both along with painted vases, and by themselves, not only in Lower Italy, but also in ancient Etruria, which have either the natural colour of burnt clay, or a black coating, or have been manufactured of clay evidently mixed with some black matter. The ornaments upon the black vases are very frequently of a white colour, sometimes yellow or red. Not only the forms, but also the colours, of the black coating and ornaments, as well as other circumstances, correspond with those which are observed in vases adorned with more perfect and more complex paintings; from which it may be supposed that these ruder, and less elegant vases, are of the same age and manufacture with those more beautiful productions of art, which, without doubt, were more highly esteemed in ancient, as they are in modern times.

The vases dug up in Lower Italy are found in Grecian sepulchres, more or less concealed beneath the surface of the ground, and constructed of stone in a rectangular form, placed near the remains of the dead body, and sometimes also suspended upon the walls; as is clearly shown by the excellent representations delineated by Knipius, added to Teischbein's plates of vases, as well as by the accurately executed models, exposed in the royal collection of vases at Naples. Many vases are also found in the same sepulchre, of various sizes and qualities. Some of these sepulchres, which are small, and constructed of rough stones, usually contain a smaller number of a coarser kind. In other sepulchres of larger size, constructed of hewn stones, and covered over with slabs like the roof of a house, some of which I have seen before the gates of the ancient Pæstum, vases of superior quality are found in great number. Sometimes they occur in their original position, and in a perfect state of preservation; at other times, however, they are crushed and destroyed. Some of them have retained in a surprising degree, their polish and original colours; others, especially those dug up in moist places, are slightly incrusted with a white calcareous substance, easily soluble in acids; this has probably been precipitated upon them from the water that had penetrated through the walls of the sepulchre. This preservation of vases, constructed at so remote a period, of such frail materials, and with so thin a coating, is a subject of much interest, and not less than the perfection of the art as practised by the ancients, invites to the investigation of their mode of formation.

We shall endeavour to distribute the most ancient earthenware vases, whether Greek or Etruscan, according to their mode of composition, into classes, for the purpose of obtaining a more distinct perception of their varieties.

(TO BE CONTINUED.)

An account of a new explosive engine, generating a power that may be substituted for that of the steam engine. By SAMUEL MOREY, of Oxford, New Hampshire.

TO PROFESSOR SILLIMAN.

Dear Sir,—Having accidentally discovered that the vapour of water and that of spirit of turpentine, when mixed with a very great proportion of atmospheric air, were highly explosive—I have been endeavouring to produce therefrom, a useful mechanical power; and embrace the earliest convenient opportunity to send you an account, and the result of some experiments. I should hope they may, at least in part, find a place in your Journal.

Alcohol may be substituted for water, or added to it in any proportion. The vapour, and atmospheric air, if placed in contact, will in time unite, as hydrogen gas and common air do, and become apparently as highly explosive. But the process by natural evaporation, would be too slow, when the use or demand was very considerable, unless the reservoir was very large, when it would then be inconvenient, expensive and unsafe. It was desirable to prepare or manufacture the article as wanted. In time it was effected. It was also very desirable, (and there was not, to me, any apparent reason why it might not be effected,) to command or control the explosions, as we do those of gunpowder, although they are much more violent. Another most desirable object, was, to unite in the same engine, if it possibly could be done, the effect or force of the explosion, with that of the vacuum, which always accompanies it; and that, without rendering it too complicated, expensive, and unsafe. By pursuing a course very analogous to that adopted for the use of gunpowder, it was in a measure, if not entirely, effected.

The preparing part of the machine consists of a metallic vessel, or tube, so constructed, that a stream or current of atmospheric air, may pass freely through it, together with the vapour or gas to be made use of; both being impelled through a space interrupted by short turns, or other impediments; the object of which is, to blend, mix, or unite them intimately with each other, by which process they are rendered highly explosive. This apparatus admits of an endless variety of forms. A description of one follows, which is found to be perfectly safe, and probably as convenient as any. Make a box of tin plates, four or five inches wide, and about fourteen long, and seven deep. Divide it horizontally, into four or five compartments, by partitions, which extend from one end of the box, to within a short distance of the other end, so that the air, entering the lower part, will be compelled, by the partitions, to travel the whole length of the box, through each compartment, in its ascent to the top;—divide these compartments, by vertical partitions, running the whole length of the box, except at the beginning, or where the air enters and passes out, into spaces, about half an inch apart, which have the double advantage, of effecting by their friction, a rapid mixture of the air and vapour with each other, and also of preventing violence in the explosion, should one take place in the box. A short tube for the admission of air and

other materials into the lower apartment, and another for letting out the explosive, or prepared air from the upper one, each covered with fine wire gauze, to prevent explosion, will complete the preparing vessel. The opening to this box should be about two inches in diameter.

The exploding part of the machine, also admits of a great variety of construction. The following may serve as a convenient one. Have a cylinder fitted with a piston or plunger, and connected with a crank shaft, as in the steam engine, let the lower end of the cylinder have a valve of at least half its diameter, opening outwards. This valve may be made of thin soft leather, of the same diameter as the cylinder. This leather is to be tied or fastened to the lower end of the working cylinder, so as to form a continuation of the same. The lower end of the leather cylinder or valve, is to be flattened, so as to bring its inner sides together, for about four or five inches of its length, and kept in that position, by light springs attached to the two edges of the flat part, placing it in a position much like that of a bow, and bow-string. This valve is supported, or prevented from being driven into the cylinder, by a plate of metal, of sufficient thickness to bear the pressure of the atmosphere, arched or raised outwards, and perforated with as many holes as can be well made in it; the holes should be from about $\frac{1}{8}$ to $\frac{1}{4}$ an inch in diameter. The end of the cylinder forms the abutment to this arched plate. An air valve, also opening outward, is fixed in the side of the cylinder, just below the piston when down. A pipe from the preparing vessel, is inserted, or attached to the side of the cylinder, at from $\frac{1}{8}$ to $\frac{1}{4}$ of the length of the stroke from the top. This pipe should be as short as it can conveniently be, and it should be furnished with a valve next the preparing box, to cut off the communication with it, and a small valve about half an inch in diameter, next the cylinder, to let the inflammable air communicate with the flame of a lamp, so as to take fire, and communicate, by the trail, to the charge in the cylinder. These valves also open upwards, but as the explosion meets with so little resistance below, they are never thrown upwards. They, as is also the air valve, are worked by beams on the crank shaft, or by any other convenient mode. To give a double stroke, it will require two cylinders fitted up in this way, communicating with the same preparing vessel and crank shaft. When vapour is intended to be used, put a little alcohol, or high proof spirit, either alone, or with the addition of a small portion of spirit of turpentine, or put in spirit of turpentine and water, or other convenient materials, capable of evaporation, and the vapour of which is inflammable, when mixed with atmospheric air, into the lower apartment of the preparing vessel; the proportion of each is not very material. Apply a small lamp, or other heating substance, to raise the temperature to about blood heat, and place the flame of a lamp, at the inflaming valve. The piston being down, in its ascent would form a vacuum under it; this is prevented by opening the air valve which supplies the cylinder with common air, until the piston reaches the pipe from the preparing vessel. It then closes, and the vapour valve supplies the remainder of the cylinder, through the preparing vessel, with the explosive air, and just

before the piston is up, say about $\frac{1}{8}$ of an inch, the vapour valve closes at the same time that the inflaming valve opens and shuts, the piston being then still rising, draws or turns the flame of the lamp at the firing valve, through the opening into the pipe, inflames the trail, and it is instantly communicated to the charge in the cylinder; the explosion that ensues, drives out the air from within the cylinder, through the perforated arched plate and leather valve at bottom, which valve instantly collapses and prevents the return of the air. The steam, formed by the explosion and formation of the vacuum, is condensed, by keeping the lower part of the cylinder cool, by surrounding it with water, and suffering the vacuum to inject a small stream of cold water near the bottom—which also keeps the arched plate, and leather valve, cool. A vacuum under the piston, instantly follows the explosion, which descends by the pressure of the atmosphere, and carries the crank with it, while the same process is repeated in the second cylinder, and the power is taken from the crank-shaft, or piston-rod, as in the steam-engine. When the temperature is low, smaller charges will produce the same effect, if a thin metallic plate of the same diameter as the piston, be introduced into the cylinder, called the charging piston. It is fitted with a small rod, which moves through a stuffing-box in the main piston, so tight, that the friction will support its weight. This charging-piston is prevented from rising higher than the vapour-pipe, by its end striking against a stationary point, in its ascent, and forming a partition between the compound air in the cylinder, and the common atmospheric air, thereby preventing so great a mixture of atmospheric air in the cylinder, as to lessen the effect of the explosion.

When the temperature of the box is so high as to give off too great a proportion of vapour, the engine works better, by stopping entirely the working of the charging piston, but not with so good economy. This charging piston should be fully perforated with small holes, lest by accident it should not rise with the working piston, as well as to let the explosion pass freely through it, to clear the cylinder. Wire gauze should also be placed between the vapour and inflaming valve, to prevent explosion in the box, should the vapour valve not close in time. When hydrogen gas is intended to be used, an apparatus similar to Professor Hare's compound blow-pipe, may be attached to the engine, to throw the air and gas into the preparing box.

A box of the form and size before mentioned, appears to be sufficient to prepare air fast enough, with a small lamp, to furnish from fifty to one hundred charges per minute, for a cylinder of seven or eight inches in diameter, having a two foot stroke, the box being in use only one quarter part of the time; it, of course, would supply four such cylinders if the air was constantly blown or drawn through it. To keep up the temperature of the box, would, in that case, probably require more heat, but it does appear, that the more rapidly the air is made to pass over the liquors, the more rapidly it takes up vapour at the same temperature.

The following, are some of the methods, I have successfully adopted, in producing a power from this same source.

I have caused the air, by the effect of the explosion, to be compressed over a column of water, to such a degree, as to throw it to a great height and distance.

I have, in a measure, reversed it, and by forming a vacuum in a vessel above, the water would be driven up, by the pressure of the atmosphere.

I have caused the explosion to compress, in a reservoir, a quantity of atmospheric air, and made use of that compressed air, for working an engine, similar to a double stroke high pressure steam engine.

This mode will make it perfectly safe on account of fire, as the compressed air may be led, in tubes, any distance, before it works the engine.

Sometimes I have made a valve in the piston to open upwards, and fill the cylinder below the piston with the prepared air, and when the piston is about half way up the cylinder, it is at the height of its working stroke; the explosion then takes place. The effect is, that the quantity of air above the piston is nearly doubled; its elasticity or force is also greatly increased, by a great increase of its temperature, it now re-acts on the piston, while a vacuum below, adds greatly to the effect. This mode acts with great energy in a small space.

I have attached to the working piston, thin tubes, about $\frac{3}{4}$ of an inch in diameter, open at top, each one of which is directly over and enters one of the tubes of a condenser, attached to the bottom of the cylinder, which tubes are $\frac{1}{2}$ of an inch in diameter. The prepared air, as usual, is let into the cylinder near the upper end; as the piston rises, it fills with the prepared air, the upper part of the tubes, and the spaces around them, and when the piston is nearly up, the explosion takes effect, but the tubes prevent all violence.

At, or near all of those springs, which are constantly giving off hydrogen gas, engines may be erected (substituting the gas for that of the vapour of the liquors) to work constantly, for every desired mechanical purpose. The engines can be placed in any chosen situation, by only conducting the gas through tubes, and if desired, the air and gas may pass in due proportion through the tubes together, which, with a few short turns, will insure its suitable preparation, although the distance should be short.

The explosive vapour engines will work without any fire, when the temperature of the weather, in the sun or in the shade, is about 80 or 90°, provided the charge be inflamed by the electric spark. With a due proportion of ether, according to the temperature of the weather, it is probable that the engine will work at any time, with only a lamp to inflame the charge.

The less is the proportion of alcohol the higher temperature will be required. So again, the more turns, back and forth, the air makes in contact with the liquor, in the box, the lower temperature will be required to prepare it. If the temperature of the box gets down to about 70°, the spirit of turpentine refuses to come over at all, or at least, in sufficient quantity to give energy to the explosion. I have lately substituted a plunger, in lieu of the piston, and attach the stuffing to the top of the cylinder; it works well, and is more conve-

nient. A small bellows is convenient in putting the engine in motion, or the explosive air may be blown into the cylinder, and inflamed, to warm it, and commence the operation.

A very easy mode, to try an experiment, for the purpose of preparing this explosive air mechanically, is to have made a few feet of inch tubes, of common tin plate. These tubes should be turned, once in about a foot, at right angles, and the long part should be filled with small tubes, about $\frac{1}{4}$ of an inch in diameter. If air is made to pass through this crooked tube, while it contains a single spoonful of high proof whiskey, and spirit of turpentine, with a proper temperature, it comes out highly explosive, if the current is forced through by a hand bellows, with ever so much velocity. As we now construct the engine and preparing vessel, it is impossible that an explosion can take place, that will injure any one. A few drops of these liquors, on a board in the sun, with a tumbler inverted over them, will explode in a short time, if a flame is applied.

It will not, I trust, appear surprising, that these improvements are patented.

I am, dear Sir, yours, most respectfully,

SAMUEL MOREY.

P. S.—I am sensible, that a drawing ought to accompany this paper, but at present, it is out of my power to furnish one.

[*Silliman's Journal.*

A method of Preserving Lime-Juice. *By Captain* T. M. BAGNOLD.

From the Transactions of the Society for the encouragement of Arts, Manufactures and Commerce.

It is well known that the Juice of lemons, or of limes, expressed from the fruit, will in a short time, especially if kept warm, become mouldy, and unfit for use as an article of food; and that the final result of this spontaneous change is the destruction of the acid itself. The acid may, indeed, be separated from the other matters with which it is naturally mixed; but in so doing all the odour and flavour of the native juice are also destroyed, for pure crystallized citric acid is wholly inodorous, and to the taste simply acid.

The effect of pure citric acid, in preventing or mitigating the severity of sea-scurvy, is greatly inferior to the recent juice; and in many of our circumnavigations, lemon or lime-juice, mixed with a small proportion of rum, about one-tenth, has been found to keep for a considerable time in tropical countries, and to be very efficacious in preserving the health of the crews. In some cases, however, this addition of spirit is by no means desirable.

In April, 1824, Captain Bagnold produced to the committee a specimen of lime-juice, which had been prepared in Jamaica in the preceding September, according to his directions. The juice having been expressed from the fruit, was strained, and put into quart bottles: these having been carefully corked, were put into a pan of cold

water, which was then by degrees raised to the boiling point. At that temperature it was kept for half an hour, and was then allowed to cool down to the temperature of the air. The process, therefore, was, in substance, only the same as that which has been long practised in this country, for preserving green gooseberries, and other fruits, for domestic use. A bottle being opened by the committee, the juice was in the state of a whitish, turbid liquor, with the acidity, and much of the flavour of the lime; nor did it appear to have undergone any alteration.

In March, 1825, some of the same juice, which had been examined the year before, and which had since only been again heated, and carefully bottled, was laid before the committee. It was still in good condition, retaining much of the flavour of the recent juice.

Hence, it appears, that by the application of the above process, the addition of rum, or other spirit, to lime or lemon juice, may be avoided, without rendering it at all more liable to spontaneous alteration.

On the Cohesive Strength of Different Metals.

FROM YOUNG'S NATURAL PHILOSOPHY.

We shall take for the measure of cohesion, the number of pounds avoirdupois, which are just sufficient to tear asunder a rod, or bundle, of one inch square. From this it will be easy to compute the strength, corresponding to any other dimension.

"1ST METALS.

		lbs.
Gold cast		20,000 to 24,000
Silver cast		40,000 to 45,000
Copper cast	Japan	19,500
	Barbary	22,000
	Hungary	31,000
	Anglesea	34,000
	Sweden	37,000
Iron cast		42,000 to 59,000
Iron bar	Ordinary,	68,000
	Stirian,	75,000
	Best Swedish and Russian,	84,000
	Horse nails,	71,000
Steel bar	Soft,	120,000
	Razor temper,	150,000
Tin cast	Malacca,	3,100
	Banca,	3,600
	Block,	3,800
	English block,	5,200
	——— grain,	6,500

	lbs.
Lead cast	860
Regulus of Antimony	1,000
Zinc	2,600
Bismuth	2,900

2ND, OF WOODS, &C.

The only author who has put it in our power to judge of the propriety of his experiments, is Muschenbroëk. He has described his method of trial, minutely, and it seems unexceptionable. The woods were all formed into slips fit for his apparatus, and part of the slip was cut away to a parallelopiped of $\frac{1}{2}$ of an inch square, and therefore $\frac{1}{25}$ of a square inch in section. The absolute strengths of a square inch were as follow.

	lbs.		lbs.
Locus tree	20,100	Pomegranate	9,750
Jujeb	18,500	Lemon	9,250
Beech Oak	17,300	Tamarind	8,750
Orange	15,500	Fir	8,330
Alder	13,900	Walnut	8,130
Elm	13,200	Pitch Pine	7,640
Mulberry	12,500	Quince	6,750
Willow	12,500	Cypress	6,000
Ash	12,000	Poplar	5,500
Plum	11,800	Cedar	4,880
Elder	10,000		

Mr. Muschenbroëk has given a very minute detail, of experiments on the ash, and the walnut; stating the weights which were required to tear asunder slips taken from the four sides of the tree, and on each side, in a regular progression from the centre, to the circumference. The numbers of this table corresponding to these two timbers, may therefore be considered as the average of more than 50 trials made of each, and he says that all the others were made with the same care. We cannot therefore see any reason for not confiding in the results; yet they are considerably higher than those given by some other writers. Mr. Pitot says, on the authority of his own experiments, and of those of Mr. Parent, that 60 pounds will just tear asunder a square line of sound oak, and that it will bear 50 with safety. This gives 8640 for the utmost strength of a square inch, which is much inferior to Muschenbroëk's valuation.

We may add to these

	cwt.
Ivory	16,280
Bone	5,250
Horn	8,750
Whalebone	7,500
Tooth of sea calf	4,075

The reader will surely observe that these numbers express something more than the utmost cohesion, for the weights are such as will very quickly, that is, in a minute or two, tear the rods asunder. It

may be said in general that two-thirds of these weights will sensibly impair the strength after a considerable while; and that one half, is the utmost that can remain suspended at them, without risk, for ever; and it is this last allotment that the engineer should reckon upon, in his constructions. There is however a considerable difference in this respect. Woods of a very straight fibre, such as fir, will be less impaired by any load which is not sufficient to break them immediately.

According to Mr. Emerson, the load which may be safely suspended to an inch square, is as follows:

	lbs.
Iron	76,400
Brass	35,600
Hempen rope	19,600
Ivory	15,700
Oak, box, yew, plum-tree	7,850
Elm, ash, beech	6,070
Walnut, plum	5,360
Red fir, holly, elder, plane, crab	5,000
Cherry, hazle	4,760
Alder, asp, birch, willows	4,290
Lead	450
Freestone	91

He gives us a practical rule, that a cylinder, whose diameter is d inches, loaded to one-fourth of its absolute strength, will carry as follows:

	cwt.
Iron	135
Good rope	22
Oak	14
Fir	9

The rank which the different woods hold in this list of Mr. Emerson's, is very different from what we find in Muschenbroëk's. But precise measures must not be expected in this matter. It is wonderful, that in a matter of such unquestionable importance, the public has not enabled some persons of judgment, to make proper trials. They are beyond the abilities of private persons.

Mr. Banks takes iron, at an average, to be four times as strong as oak, and $5\frac{1}{2}$ times as strong as deal or fir.

According to the experiments of various authors, the cohesive strength of a square inch of razor steel, is about 150,000 pounds; of soft steel, 120, of wrought iron 80, of cast iron 50, of good rope 20, of oak, beech, and willow wood, in the direction of their fibres, 12, of fir 8, and of lead about 3,000 pounds; the cohesive strength of a square inch of brick 300, and of free stone 200; teak wood, the tectona grandis, is said to be still stronger than oak.

The strength of different materials in resisting compression, is liable to great variation. In steel, and in willow wood, the cohesive, and repulsive strength, appear to be nearly equal. Oak, will suspend much more than fir; but fir, will support twice as much as oak, proba-

bly on account of the curvature of the fibres of oak. Freestone has been found to support about 2000 pounds, for each square inch; oak, in some practical cases, more than 4000.

The strongest wood of each tree, is neither at the centre, nor at the circumference, but in the middle between both; and in Europe it is generally thicker and firmer on the south-east side of the tree. Although iron is much stronger than wood, yet it is more liable to accidental imperfections; and when it fails, it gives no warning of its approaching fracture. The equable equality of steel may be ascertained by corrosion in an acid, but there is no easy mode of detecting internal flaws in a bar of iron, and we can only rely on the honesty of the workmen for its soundness. Wood, when it is crippled, complains, or emits a sound, and after this, although it is much weakened, it may still retain strength enough to be of service.

On Bronzing Brass Goods.

The first thing to be attended to in this art, is the preparation of the bronze to be used. Many receipts have been given for preparing this, but the two following we think decidedly the cheapest, and the best we have seen.

Receipt for making Green Bronze.

Take one quart of strong vinegar; half an ounce of mineral green; half an ounce of raw umber; half an ounce of sal ammoniac; half an ounce of gum arabic; two ounces of French berries; half an ounce of copperas; and about three ounces of green oats, if these can be procured; although, if they cannot, the preparation will succeed perfectly well without them. Dissolve the different salts, and gums, in small portions of the vinegar; then mix the whole in a strong earthen vessel, adding the berries and the oats, over a gentle fire: bring the compound to boil. Then allow it to cool, and filter it through a flannel bag, when the bronze will be fit for use.

Receipt for making Bronze commonly used by Brass-founders.

Take one English pint of strong vinegar; one ounce of sal ammoniac; half an ounce of alum; a quarter of an ounce of arsenic: dissolve them in the vinegar, and the compound is fit for use. This bronze frequently answers perfectly well when the vinegar and sal ammoniac alone are used. We know brass-founders who have been in the habit of using this cheap composition for several years; and, where the metal is good, it is very seldom found to fail.

The bronze being now prepared, the next thing to be attended to is the cleaning of the brass-work, to be bronzed; and the best method for

Cleaning work previous to using Bronze,

Is either by filing, turning, rubbing with sand-paper, or dipping in aqua-fortis. It is absolutely necessary, in order to be successful, to have the work well cleaned, and free from grease, especially; and the

latter of these methods is certainly the best, and therefore ought always to be used when it is wished to succeed particularly well, although any of the above methods are perfectly sufficient for ordinary purposes.

Having thus got the bronze and the work ready, we now proceed to describe the manner

Of Bronzing.

This must be done with a small brush, and great care must be taken to keep the work constantly wet with the liquid, to prevent it turning green. When the colour which is wished has been attained, which will generally be in from twenty to thirty minutes, the work must be quickly washed in clean cold water, and then dried in soft warm sawdust, after which the whole is laid over with a coating of lacker, which preserves the colours.

It often happens, however, from the quality of the brass, that the bronze will not bring the work to a sufficiently dark colour; means must be used to remedy this defect, and we think

The best and cheapest method of giving the proper dark tinge to Bronze, When, from the nature of the metal, we cannot otherwise succeed, is the following. Mix about a quarter of an ounce of the finest lamp black, with about one gill of strong spirit of wine, and strain the mixture through a fine linen cloth. The work on which the bronze has been already used, must then be warmed upon a cistern plate, or over a clear fire, until it can scarcely be held in the hand. Then, with a fine camel hair brush, such as is used for lackering, the work must be laid over with this mixture, in very thin coatings, until the shade required, be obtained. When cold, it must be polished with a very soft brush, or piece of linen rag, dipped or moistened with clear green oil. A coating of lacker is then laid over the whole, and the most beautiful bronze will be obtained that can be produced on brass; and, if the work is not made too black with the mixture, nor the lacker used of too bright a yellow, the bronze obtained, will be a beautiful dark green —the colour now so much used by the English brass-founders. By this it will be seen, that any shade of what is called green bronze can be obtained, simply by using more or less of the blacking, and a lighter or darker colour of the yellow lacker; and the different tints wished to be given to the work will of course be obtained by the different thickness of the coatings of blacking which the several parts of the work receive. The work, however, will stand much longer in colour, when the bronze can be made sufficiently dark, without using the blacking at all; and this can be done, although it takes longer time than is required when the blacking is used.

Method of giving the Bronze the proper shade without using the Blacking.

When either of the bronzes, first described, have been used, and the work dried, as there described, if the shade should not appear so dark as is wished, let the work be placed before a smart fire, or in bright sunshine, where, however, no current of air passes. When thus ex-

posed, let it be turned occasionally, and brushed with a soft brush. This plan will be found to produce a very fine bronze, after all other means have failed, (with the exception of the blacking) but it is tedious, and where time is an object, it will always be found best to use the blacking.

We are aware that many other receipts for making bronze are to be met with; but those we have given, are decidedly the best, and cheapest, used, and are the best fitted for practical people. In our next we shall give some equally cheap receipts for making lackers, with practical observations on lackering.

Remarks by the Editor. The foregoing article is copied from the Glasgow Mechanics' Magazine, and upon the credit of that valuable work, it is inserted; the Editor has not tested the processes, but it is his design so to do; when the result shall be made known. The object of bronzing, is to give to articles an appearance similar to that which statues, &c., made of the alloy called bronze, acquire by age. The manner of effecting this on wood, and on plaster casts, differs essentially from that above described, and shall be given in our next number. The liquid by which brass is bronzed, corrodes its surface; figures of plaster of Paris, or of wood, are coated, as with paint.

Improvement in Steam Vessels.

There is said to be a contrivance now employed on board a Scottish steam vessel, which might be used to great advantage to other vessels, of a similar kind. By the simple motion of a small handle or index, placed on a table upon deck, in view of the man at the helm, and of the master of the vessel, every movement which the engine is capable of giving to the paddle wheel may be at once commanded. The vessel may be moved backwards or forwards, or may be entirely stopped at any given movement by merely turning the handle to the place denoted by the gradations of a dial plate. No skill is required for this purpose; the master himself, or a sailor under his direction, can perform the office, as well as the ablest engineer. Thus the confusion which frequently arises at night, in calling to the engineer, is avoided, and any ambiguity, arising from the word of command being transmitted through several persons, avoided, (circumstances which may lead to the most serious accidents.) The engine is by this contrivance, as much under command, as the rudder.

Economical Refrigerator for cooling Water.

Mr. Meer of this city, has invented a very economical apparatus, for containing water, and reducing its temperature, on the principle of evaporation. It is formed of burnt clay, composed as follows; about one part of common red potter's clay, and three parts of micaceous clay of an open texture: it is made in the form of a cylindric jar, and holds about six gallons; a hole is formed near the bottom, to

admit a cock or spigot. This jar is placed on three cubes of wood, in a glazed pan of brown earthenware, made to receive any water, which exudes from the porous sides and bottom of the jar, should more pass than is carried off by evaporation. In the inside of the jar, is placed a narrow earthen vessel, nearly long enough to touch the bottom, and suspended from the top, by its rim; this is to contain ice, when it is required, to render the water extremely cold. By this contrivance the ice remains long in the solid state, and does not, when melted, mix with the water in the jar, to render it foul, or otherwise unpleasant, whilst not half the quantity is required, as in the common practice.

This simple and cheap apparatus, will be found to be very useful, for public or private houses: one in complete operation may be seen at No. 4, south Seventh street, opposite the Franklin Institute, where the curious are invited to examine it.

They can be had at Messrs. Headman's Pottery, No. 17, south Eighth street. J. M.

Notice of Nicholson's Operative Mechanic.

We have, in some of our former numbers, made some extracts from the miscellaneous part of NICHOLSON'S OPERATIVE MECHANIC, and have spoken of the work in terms of approbation. An improved edition of this book, has just issued from the press of Messrs. Carey & Lea, of this city. The compiler, Mr. John Nicholson, is the son of the late William Nicholson, whose Philosophical Journal, and other valuable scientific works, are well known. The volumes before us, are an interesting compend, of the most important arts and manufactures of Great Britain. Most of the articles, are selected from larger, and more general works, rarely accessible to those engaged in manufactures: the work contains also, a considerable portion of matter, supplied by those engaged in the various operations of which it treats, and by the observation and experience of Mr. Nicholson himself, in several of the manufactories. "A Book comprehensive and practical, embracing the whole subject, as living and contemporaneous, and as connected with private profit, and public glory, instructive to individuals, and illustrative of the genius of the age, in its best direction, has been the object of the Author," and we think he has not laboured in vain.

From a very reprehensible oversight in the English edition, numerous letters of reference, which were found in the text, had not been inserted on the plates; in the edition of Messrs. Carey & Lea, this has been carefully attended to, *many hundred* omissions of this kind, having been supplied. There are also several additional copperplates, illustrating some of the most important American inventions, of which descriptions are given. The two plates in our present number, are a part of them, the others represent the forcing pump, &c. at the Fair-mount water works, fire-engines, mill work, printing press, lathe, &c.

There are but few mechanics, and manufacturers, to whom this work

will not supply useful information; whilst to the general reader, who is fond of mechanical pursuits, it will give a more comprehensive and interesting view of the subjects upon which it treats, than is to be found in any other single publication.

List of New Patents, in England, which have passed the Great Seal, since April 18, 1826.

John Billingham, civil engineer, for an improvement, or improvements, in the construction of Cookery apparatus. Dated April 18, 1826.

James Kowbotham, and Robert Lloyd, for a method of preparing, forming, uniting, combining, and putting together, certain materials, substances, or things for the purpose of being made into hats, caps, bonnets, cloaks, coats, trowsers, and for wearing apparel in general, and various other purposes. Dated April 18, 1826.

To William Wood, for an Apparatus for destroying the Inflammable air (which is commonly known by the name of Fire-damp) in Mines. Dated April 22, 1826.—To be specified in six months.

To John Petty Gillespie, for a new Spring, or combination of Springs, for the purpose of forming an Elastic Resisting Medium. Dated April 25, 1826.—In six months.

To Samuel Brown, for certain improvements on his former patent. Dated December 4, 1823, for an Engine, or instrument, for effecting a Vacuum, and thus producing powers by which Water may be raised and Machinery put in motion. Dated April 25, 1826.—In six months.

To Francis Halliday, for an apparatus or machine for preventing the inconvenience arising from Smoke in Chimneys, which he denominates a Wind-guard. Dated April 25, 1826.—In six months.

To John Williams, for certain improvements on Ships' Hearths, and apparatus for Cooking by Steam. Dated April 27, 1826.—In two months.

To William Choice, and Robert Gibson, for certain improvements in machinery for making Bricks. Dated April 27, 1826.—In two months.

To Charles Kennedy, for certain improvements in the Apparatus used for Cupping. Dated April 29, 1826.—In six months.

To John Goulding, for certain improvements in the Machines used for carding, slubbing, slivering, roving, or spinning, Wool, Cotton, waste Silk, short stapled Hemp and Flax, or any other fibrous materials or mixtures thereof. Dated May 2, 1826.—In six months.

To Arnold Buffum, late of Massachusetts, in the United States of America, but now residing in the city of London, (being one of the people called Quakers,) and John M'Curdy, who, in consequence of communications made to them by a certain foreigner, residing abroad, and discoveries made by themselves, are in possession of an invention of improvements in Steam Engines. Dated May 6, 1826.—In six months.

To Sir Robert Seppings, for certain improvements in the construc-

tion of Fids, or apparatus for striking Top-masts and Top-gallant-masts in Ships. Dated May 6, 1826.—In six months.

To William Fenner, for an improvement in machinery or apparatus for curing smoky, and cleansing foul Chimneys. Dated May 6, 1826.—In six months.

To Alexander Allard de la Court, for a new instrument and improvements in certain well known instruments applicable to the Organ of Sight. Dated May 6, 1826.—In six months.

To Joseph Schaller, for certain improvements in the construction or manufacture of Clogs, Pattens, or substitutes for the same. Dated May 6, 1826.—In six months.

To Edward Heard, for a certain new composition or compositions to be used for the purpose of washing in Sea and other Water. Dated May 8, 1826.—In six months.

To Levy Zachariah, jun., for a combination of materials to be used as Fuel. Dated May 8, 1826.—In six months.

List of Patents issued in the United States, from the 8th to the 19th of June, 1826.

Improvement in the construction of Chimneys, June 8, Abraham G. D. Tuthill, Utica, Oneida Cy., New York.

In the turning lathe, June 8, John Hunt, Shutesbury, Massachusetts.

In Grist Mills, June 9, Francis Harris & John Wilson, Troy, New York.

In the mode of taking the cotton from the doffer, June 9, Elijah Thompson, Lowell, Massachusetts.

In the machine for making boots and shoes, June 9, Elijah Thayer, Leicester, Massachusetts.

In the machine for moulding bricks and tile, June 9, Ezra Fisk, Fayette, Maine.

In the Machine for roping and spinning cotton, June 10, William Carmichael, Sand Lake, New York.

In the rolling or twisting roving of cotton, June 14, William Whitehead, jr. Paterson, New Jersey.

In the instrument for operating for the cancer, June 14, Thomas R. Williams, Philadelphia.

In Paul Pillsbury's machine for shelling corn, June 15, Jeremiah Dodson, Guilford, North Carolina.

In the Loom, June 14, Cornelius Bergen, New York.

In the mode of emptying the well bucket, June 15, Elijah Willard, Egremont Massachusetts.

In the machine for spinning wool, tow, &c. June 15, John Corrill & William P. Rogers, Harpersfield, Ohio.

In the machine for drawing canal boats for repair, June 16, Seth C. Jones, Rochester, New York.

In the percussion lock, for rifles, muskets, &c. June 16, Joseph Medbery & Silvester Kellogg, Rochester, New York.

In the mode of applying water to water wheels, June 19, D. M'Kenzie, M. L. Barber, S. Dean, and John C. Narlghton, Caledonia, New York.

In the machine for bending tire for wheels, June 19, Walter Janes, Ashford, Connecticut.

In the machine for weighing canal boats, June 20, Benjamin Bull, New York.

The article headed "French Patent," was by mistake of the printer, placed among the English Patents; it was intended to have followed them.